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The JOURNAL of the DEPARTMENT of AGRICULTURE

VICTORIA - AUSTRALIA

VOL. XXXI PART 8

NATIONAL MUSEUM OF VICTORIA

AUGUST, 1933 Price 3d.

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Issued under the direction of the Hon. J. Allan, M.L.A., Minister of Agriculture.

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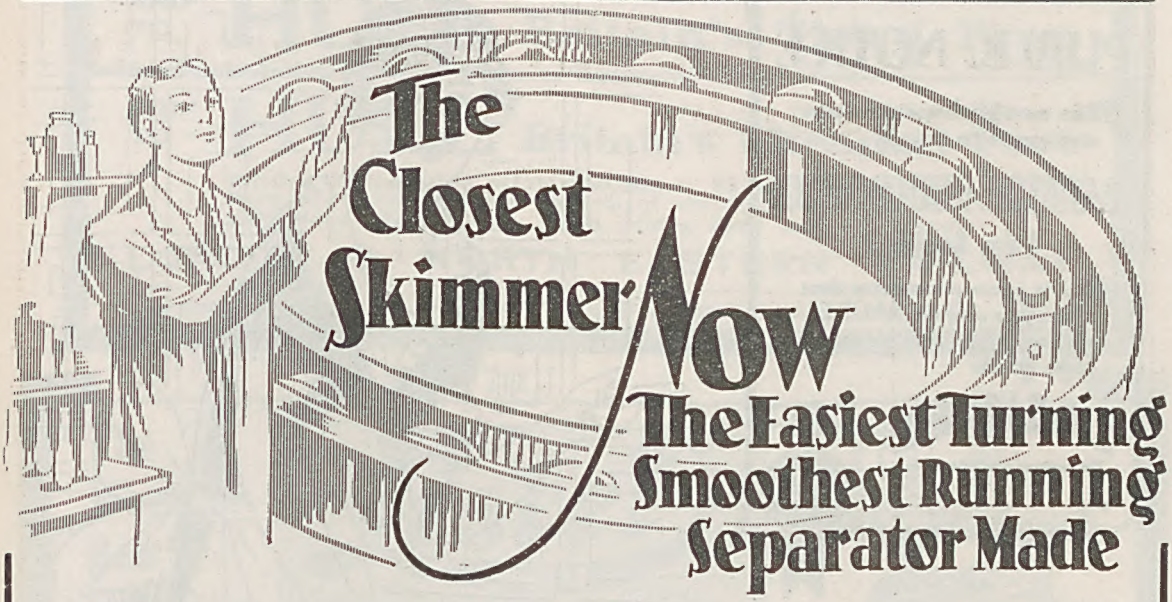

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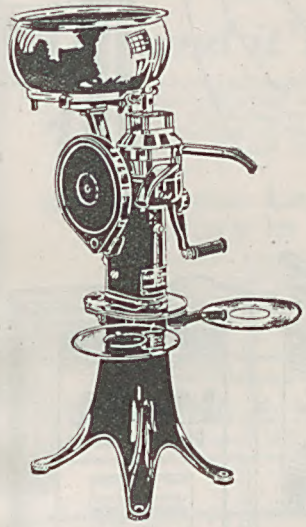

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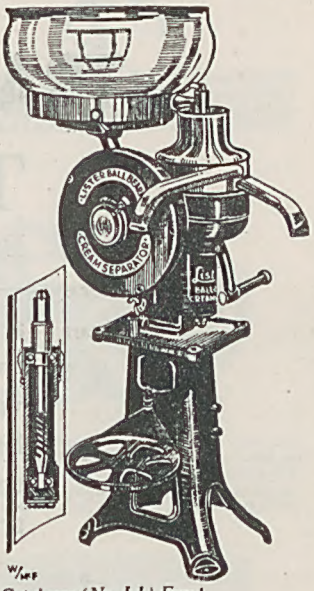

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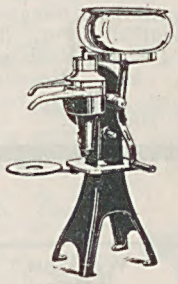

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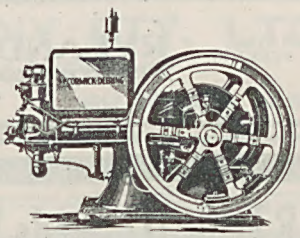

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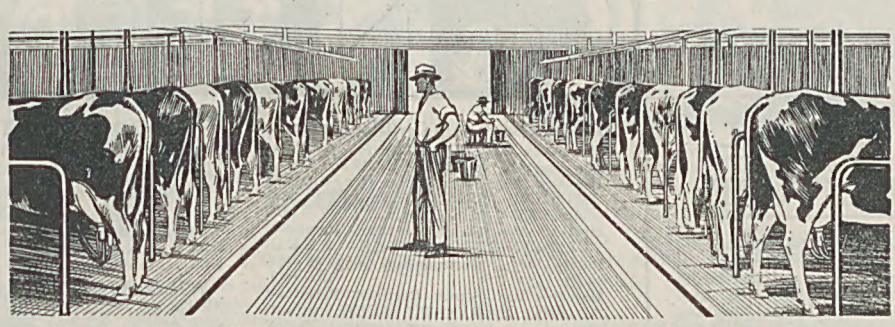

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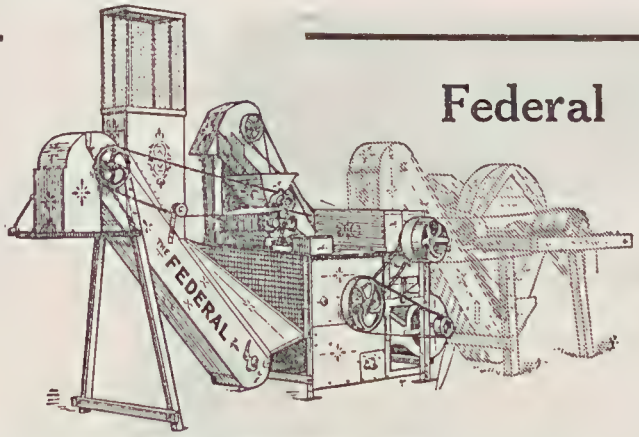

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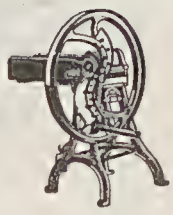

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NATIONAL MUSEUM OF VICTORIA

The Journal of the DEPARTMENT of AGRICULTURE of VICTORIA

Permanent Pasture Establishment

Spring Sowings

By E. D. Cameron, B.Agr.Sc., Assistant Agrostologist.

WHERE a farm is situated in an area capable of carrying grazing stock for twelve months, the pastures should be so constructed and managed that all-the-year-round grazing is provided. If a food shortage of even a few weeks' duration is not to reduce seriously the numbers of stock carried, the pastures should give grazing as regular as climate and soil will allow, and the farm should carry also reserves of meadow hay and ensilage sufficiently large to adequately supplement the pastures and keep the stock well fed.

In this article it is proposed to outline the main practices and principles to be followed in the spring sowing of permanent pastures, the remarks being complementary to those made in the April, 1932, issue of this Journal, in which autumn sowing of pastures was dealt with.

In districts where the rainfall during spring and summer is moderately high and reliable, opportunity exists for the cropping of a field in winter, with, say, oats prior to the preparation and sowing down of the field to permanent pasture grasses such as ryegrass and cocksfoot. Unless such conditions exist, however, spring sowings usually are risky. Inadequate rains during the establishment period, followed by a dry summer, in most cases, will be sufficient to kill many of the young grass seedlings, and result in an inferior pasture. With certain summer-growing grasses, such as Golden Crown (Paspalum dilatatum), however, it is necessary to sow in the spring, because, with them, germination takes place only when high soil temperatures are reached. If sown in the autumn, these seeds would remain in the wet, cold ground until possibly many of them would be injured by excessive moisture, and fail to germinate at all, even under high temperatures. There is also the chance that any seedlings of these summer grasses which do develop in the autumn or winter will be smothered by winter weed growth. Species such as paspalum and lucerne are practically at a standstill in the winter months, and are thus unable to compete, particularly in the first years of their establishment, with winter-growing weeds, such as sorrel and capeweed.

In low rainfall areas autumn sowing alone is practicable. Annual species or a mixture of annual and perennials must be used, and the conservation of excess spring growth as hay or ensilage becomes of special importance. The sowing of winter and summer fodder crops also may be desirable, for, by these several means only, may uniform and profitable production be obtained.

Soil Preparation.

The first point of importance in the sowing of any grass seed is the careful and thorough preparation of the seed bed. If high quality seed has been selected, any failures in the establishment of a pasture are probably due to the poor preparation of the soil. In a coarse, uneven seed bed the germination of the finer grass and clover seeds is hampered, while the vigorous growth of weed seeds appears to be assisted by lack of competition. With careful preparation, however, the small seeds germinate and establish well, and will be better able to withstand the initial attack from weeds. Subsequent weed growth then will not be so dangerous.

The methods of soil cultivation vary slightly for autumn and spring sowing. With spring sowings the land may have been ploughed in the autumn, and sown to an early maturing crop, such as early oats for winter feed. When this crop is harvested, surface cultivations probably will be sufficient to bring the soil into a fine, firm, and clean condition. The cleanliness, however, will depend on the frequency of surface cultivation. In the early spring the annual and objectionable plants, such as capeweed and dandelion, are most vigorous, and frequent cultivations are the only means of controlling their growth prior to sowing.

Alternatively, the land may be ploughed in the autumn or winter, and then left as fallow until the spring. In this case the field should be kept clean by surface cultivation every time soil and weather conditions allow. Another cultivation just prior to sowing will leave the land in good condition for receiving the small grass seed.

The practice of spring sowing permanent pasture mixtures with a light cover crop, such as millet, to be cut or fed off later is adopted occasionally. The cover crop has the advantage of producing extra fodder to be used during the lean summer months if cut, while if fed off, of giving the extra feed so that other fields may be reserved for grass hay or ensilage making. It also gives protection to the grass and clover seedlings from "burning" and frosts, and, to a certain extent, checks weed growth. On the other hand, there are several disadvantages. The cover crop makes a heavy drain on the available plant foods at the expense of the young pasture, and, unless sown light, is liable to "lodge," in which case the pasture on this area probably will be killed.

If climatic conditions remain favorable, a spring sowing without a cover crop will be productive as a pasture earlier than a mixture sown with such a crop. If sown alone, the pasture will present the opportunity for a judicious grazing, which will tend to strengthen and produce more robust plants. These plants will be better able to stand up to a hot summer.

Where a cover crop is to be sown, its selection is determined by two main factors. Quick growth, capable of affording early protection, together with a fairly large production of feed at the particular time of the year, are the two essentials. In this respect, oats, wheat, barley, and millet offer themselves as the crops suitable for use. With oats, wheat, or barley, the crop may be fed off or left for hay. In the latter case the tall growth will tend to inhibit the development of certain low-growing species, particularly the clovers. With millet or oats fed off each time the crop reaches 8 inches to 9 inches in height, smothering effect is greatly minimized, and the tramping consolidates the soil, making it more suitable for grass establishment. Wimmera and Italian ryegress also are favoured as a cover crop in some districts. Both are quick growers, giving a bulk of feed in the winter. However, they cannot be recommended for use for spring sowings.

Factors Determining Species.

Having got the seed bed in good condition, the next step in the laying down of a permanent pasture is to determine the species to be sown. This will depend on the following three main considerations:—

1. *Rainfall.* The question as to whether winter or summer growing species will be sown depends not only on the amount of rainfall, but also on its incidence, or evenness of distribution. If the rainfall occurs mainly in winter, it will be difficult to get summer-growing grasses, such as cocksfoot and paspalum, to stand, and in fact under such conditions a spring sowing must be regarded as doubtful. An all-the-year-round grazing proposition can be maintained only where the distribution of rainfall is fairly even and temperatures are not too high. The high temperatures experienced in the summer months require a high rainfall to combat the increased evaporation, and ensure that the soil moisture available to the plants is always adequate.

2. *Soil type.* This is important, because different species do better on different soil

types. For example, subterranean clover prefers a light soil, whereas white clover and perennial ryegrass thrive better on heavy soils.

3. *Farm Requirements.* The actual pasture requirements of the farm deserve attention. Lack of feed in the summer will make the maintenance of summer growing species more important. Conversely, winter growers may be of paramount importance. For all-the-year-round grazing a mixture of both summer and winter grasses will be needed.

Paspalum is essentially a summer-growing plant, capable of withstanding fairly dry conditions. It is dormant in the winter. The rate of establishment is slow, the plant taking usually two years to assert itself in a mixture. The objection that paspalum tends to become tussocky and coarse can easily be overcome if it is kept well grazed. Under controlled grazing it will remain leafy and palatable to stock, and, when established, will give a green bite during the summer months when most other pasture plants are hard and brown.

A Permanent Pasture in the Western district.

Species for Spring Sowings.

While it is considered undesirable to attempt to recommend pasture mixtures for the many and varied conditions which exist, it is thought that notes on the species which may be sown in the spring, either separately or in mixtures, will be helpful.

Perennial ryegrass may be sown in spring with most safety. It is eminently suited to heavy land with a moderate rainfall. It produces the bulk of its feed during the spring and autumn months, is dormant in the summer, but makes fair growth in the winter. When established it will withstand hard grazing. When spring sown it is necessary to graze leniently until the plants become well rooted in the following autumn.

Cocksfoot, on the other hand, makes its main growth during the spring, summer, and autumn. It is a poor winter grower, suited to loamy soils in districts of fair summer rainfall. Under such soil conditions cocksfoot should be the main constituent of a mixture, with ryegrass sub-dominant.

Lucerne also is a summer-growing plant capable of withstanding dry summer conditions when sown on soil which permits of free and deep root development. When sown in the spring, lucerne should be allowed from two to three months to become firmly established before the initial cutting, or lenient grazing. Thereafter it may be grazed intermittently or cut three or four times during the summer and autumn. In winter it makes little growth. The seed should be sown on a clean seed bed at the rate of from 10 lb. to 15 lb. per acre if sown as a pure stand. In mixtures, from 2 lb. to 3 lb. should be included.

White clover is considered the companion plant of perennial ryegrass, and should be included in a spring-sown mixture under good rainfall conditions. If conditions are favorable, white clover will grow throughout the year, making most of its growth during the autumn and spring.

Strawberry clover is a perennial clover also suited to heavy soil conditions. It is slow in developing, but even a light sowing will permit

of ultimate establishment, giving greatest growth during the summer and autumn months.

Subterranean clover is an annual clover which should be sown in the autumn if success is to be assured. It may be possible, however, during favorable seasons to sow this clover in the early spring, and still secure a sufficient setting of seed to give a fair stand the following autumn.

Suitable Strains.

With species decided upon, a further point worthy of the closest consideration arises—the question of strain. During recent years many workers have devoted themselves to this phase of pasture management, with the result that many strains of grasses and clovers have been evolved and segregated.

Many failures in the sowing down of pastures have been attributable to the fact that unsuitable strains have been used. Particularly is this the case with perennial ryegrass cocksfoot, and white clover, which are the species used mainly in high to moderate rainfall areas. In the case of perennial ryegrass it has been demonstrated by the Agrostology Branch of the Department of Agriculture that Victorian perennial ryegress, particularly that of the Western District, Central Victoria, and Gippsland origin, is of an excellent type, being both leafy and persistent, and making good winter growth.

With cocksfoot, also, Victorian strains have been shown to be of a desirable type, highly suitable for the establishment of permanent pastures in those areas where cocksfoot thrives. As yet white clover is not harvested in Victoria, so that any sowing down of this clover must of necessity be with imported seed. Of those submitted for trial at Burnley, New Zealand white clover has shown itself to be a suitable pasture type.

In the case of subterranean clover, numerous strains have been segregated, but as yet they are not available on a commercial scale. The great bulk of commercial seed belongs to a mid-season type, well adapted to general conditions.

Particular strains usually command a slightly higher price than the ordinary commercial lots. This should not act as a deterrent to their purchase. It is far better to pay an extra few shillings in the initial outlay than to have to re-sow the field the following year.

Sowing the Seed.

With species and strain selected, the next question of importance is that of time of sowing. This will vary largely even within each district, so that a definite statement in that direction is impossible. It will suffice to say that sowings should be made as early as possible after the land is thoroughly prepared and in a suitable condition to receive the seed. As a general rule, however, sowings in the Western District should take place not later than September, while in Gippsland, October and November are considered the best months for spring sowings.

The methods to be used in sowing are fairly definite, however. The first essential to successful establishment is shallow sowing of the seed. This may be readily understood when it is realized that grass seed is small, and that deep sowing may prevent the young leaf shoots from developing sufficiently to reach the surface and function in the supply of food material to the plant. A light harrowing and rolling after surface sowing will suffice to cover the seed.

It is advisable to topdress with superphosphate at sowing time. In this way the phosphate required will be immediately available as soon as germination takes place, so giving the plant a good start. The optimum amount of super. to be applied depends on many conditions, and should be determined by previous experience. A dressing of about 1 cwt. per acre is the normal practice, but in special circumstances it may be advisable to apply more, and in some cases less. It is better to err on the side of liberality rather than deficiency.

With the seed sown under good conditions, it requires only normal climatic conditions and careful after-management to give rise to a productive pasture which will give all-the-year-round grazing. The first grazing should be light, with a fairly long spell. Subsequently heavier grazings may be adopted in rotation with other pastures. In the spring of the year excess growth will be produced with which the stock normally carried will not be able to cope. It then remains for a paddock or two to be closed for hay, which may be cut and held in reserve for the leaner winter and summer months of the year.

Red Poll Cattle

Effects of Breeding and Selection

By A. C. T. Hewitt, M.Agr.Sc., Dairy Herd Manager, State Research Farm, Werribee.

THE Red Poll, the only hornless breed of English cattle, resulted from the skilful mating, over a period of more than 100 years, of the old Norfolk and Suffolk cattle. From this mating was evolved an excellent type of animal, combining the deep red colour and beef-producing qualities of the Norfolk with the polled characteristic and milk and butter-fat producing qualities of the Suffolk.

From the point of view of quality and quantity of milk produced the breed has always borne a good reputation, and in Australia this reputation has been strengthened by the performance of the Victoria herd of Red Polls conducted by the Department of Agriculture at the State Research Farm, Werribee, during the past 24 years. The average production of the 195 cows tested in this herd during the last five years has been no less than 7,847 lb. milk, 4.38 test, and 343 lb. butter-fat, equivalent to 422 lb. butter-fat after adding the allowances for heifers.

The early maturing, prime beef producing qualities of the Red Poll were clearly demonstrated at the Melbourne Royal Show in 1930. The carcass class open to all breeds, and contested by steers representing the Red Poll, Shorthorn, Hereford, and Aberdeen Angus breeds was won by a pair of two-year old Red Poll steers with a total of 95 out of a possible 100 points. Though only two years old, the winners weighed 1,184 and 1,264 lb. live weight, and dressed out 62 and 61 per cent. respectively. These steers, which were exhibited by Messrs. J. and N. Bott, of Yarrawonga, were bred from stock imported from the English studs of the Duchess of Montrose and the Earl of Stradbroke.

Red Polls commence to make good right from the start. The birth weight of calves at Werribee has averaged 77 lb. for bull calves and 72 lb. for heifer calves. These calves can be developed into prime vealers, prime baby beef, or prime mature beef, while the heifers can also be developed into good dairy cows or good mothers for rearing calves. At Werribee, the aged cows that are retained for breeding purposes are often allowed to rear calves. Many of these cows are fifteen years old, and they always rear two, and frequently three, calves at once.

Red Polls are extremely docile animals and respond to kind treatment. The bulls are easily handled, and the cows are quiet to milk. The breed, which is now very popular and widely distributed, is particularly suited to the mixed farming and lower rainfall districts of Victoria, in fact, to all Australia.

In this short article it is proposed to deal briefly with the effects of breeding and selection on increased milk and butter-fat yields, the material for this study having been obtained from the Werribee herd already referred to, the figures for which speak highly for this dual purpose breed. The breeder of other types of dairy cattle has dairy characteristics only to consider when making his selections, but the Red Poll breeder has to have as his objective an animal suitable for the butcher as well as giving satisfactory milk and butter-fat yields. This necessitates the culling of both the lean, heavy producing dairy types, and the fat, low-producing beef types of animals that are apt to occur. If this culling were not done, a herd would tend to lose the dual purpose characteristics for which the Red Poll is so justly famed.

The departmental Red Poll herd was founded in 1909 by the former Director of Agriculture, Dr. S. S. Cameron. Since its foundation, all the cows have been under test, and to-day we have over 600 milk and butter-fat records from 240 cows. Red Polls, as we know them in Australia to-day, were not to be obtained in 1909, and it was extremely difficult to buy good representatives of the breed. To found the State Research Farm herd, 105 Red Poll females and six bulls were purchased. Very little was known of the productive ability of these foundation cows, and scientific selection and breeding were commenced early. Before they were bred from, 35 cows out of the original 105 foundation cows were weeded out, and gradually others that were poor producers themselves or that were failing to transmit high milk and butter-fat production to their progeny were eliminated from the stud. The results have been such that to-day the whole herd of approximately 170 head includes the direct descendants of only ten of the original 105 foundation cows.

A statistical survey of the test records shows that the original ten foundation cows produced an average return of 359 lb. butter-fat, compared with an average of 335 lb. butter-fat produced by all the foundation cows tested. In each subsequent generation that has followed from the ten foundation cows, gradual increases in production have been obtained, and to-day the majority of the cows are in the fourth, fifth, and sixth generations. The average production of these cows is 410 lb. butter-fat, or 22 per cent. more than was produced by the ten foundation cows.

Careful selection and culling have been carried out continuously, and it has been found that the average production of these culls has varied very little, being about 350 lb. butter-fat, just 15 lb. above the average production of the 105 foundation cows.

This survey of the production records of a pure-bred herd over a period of 24 years emphasizes the need for continual herd testing, so that the breeder is always able to weed out the lower producing cows. Should a dairy herd not be culled continuously according to the production records of the cows, it would tend to revert to the basal level of production for the breed under the conditions to which it is subjected. At Werribee, this level would be in the vicinity of 300 lb. butter-fat.

Victoria Joan of Arc, dam of the junior herd sire, Victoria John Bull. This cow gave 569 lb. butter-fat in 273 days' test.

Victoria White Rose—a cow showing well-developed beef and dairy characteristics.

Another statistical survey of the records of the departmental Red Poll stud has shown that certain bulls increase, while other bulls decrease, the production of their daughters over or below that of the dams of these daughters. The bulls that increase production are known as proven sires, and such bulls are necessarily six to seven years old before their value is known. Very few proven sires are alive in Victoria to-day, since most bulls reach the chopping block before they are five years old. If a bull is worth selecting as a herd sire, and if his calves are satisfactory, he is well worth keeping until his daughters are herd-tested, when the progeny test can be applied. Bulls that pass this test and become proven sires should be used for stud purposes as long as possible. If properly cared for, bulls remain active and good calf getters until they are twelve to fifteen years old. At Werribee, Belligerent and Vice-Regal were used successfuly for stud purposes until they reached the ages of fourteen and twelve years respectively. Proven sires in the Werribee herd are Nicotine, Belligerent, Victoria Volcano, and Victoria Air Marshal, and we are now inbreeding with descendants of these bulls to accentuate the desirable characters that they transmitted to their progeny. A bull that fails in the progeny test should not be bred from further.

The selection of a herd sire requires judgment and thought, and if a proven sire is unprocurable it will be best to select a strong vigorous young bull that conforms with the standards for the breed so far as type is concerned. Not only should his dam be a high producer herself, but she should have also high-producing daughters. His sire also should have high-yielding daughters.

It has been demonstrated that the method of breeding plays an important part in the production of a herd. Once the highest producing strains have been segregated out, these high producing strains should be linebred. "Linebreeding" is inbreeding with distinctly but distantly related animals, and in the Red Poll stud at Werribee increased production has been obtained by this method. "Close-breeding" is inbreeding with closely related animals, such as brother and sister or parent and progeny, while "outcrossing" is breeding with unrelated animals. Both by close-breeding and outcrossing milk and butter-fat production have been lowered at Werribee. A heavy producing cow must be vigorous and have a strong constitution, and since loss of vigour and weakness of constitution are associated with close-breeding, this method should be avoided.

The success attained with Red Polls at the State Research Farm, Werribee, in raising the average butter-fat production of the herd by 75 lb. butter-fat per cow in 24 years to the present standard of 410 lb. butter-fat, is attributed mainly to the following factors:—

(1) Continuous herd-testing, so that the breeder knows exactly what each cow is producing;

(2) The selection of the most desirable and highest producing cows for breeding purposes;

(3) Culling all the low-producing, undesirable cows and strains as soon as they can be replaced by heifers from the higher producing cows;

(4) Line-breeding with the high producing strains; and

Dominion Bright Belgian.

(5) The selection of suitable herd sires, and the increased use of proven sires.

It might be thought that milk and butter-fat production in Red Poll cattle would be increased only at the expense of beef production, but this is not the case when proper selection is carried out. It is not economic to produce milk and beef from the one cow at the same time, hence heavy milking cows lose condition as their lactations advance and fatten up quickly when they are dry. Again, heavy milking cows must consume large quantities of feed from which to produce their high milk yields. The consumption of these large quantities of feed increases the size of their barrels. These large barrels, together with the large udders, make the heavy producing Red Poll cows typically wedge-shaped as they reach maturity as in other dairy breeds. Nevertheless the Red Poll calves, steers, heifers, and the bulls carry good condition, and can be topped off for the butcher very quickly, and are typically rectangular like true beef cattle.

Pasture Improvement Work

FOR some years now the Department of Agriculture has been conducting experimental plots in various parts of the State to determine and demonstrate the value of artificial fertilizers on pasture land. Recently more intensive work in pasture improvement has been undertaken. In 1932 the Department, in co-operation with the Victorian Pasture Improvement League, established experimental plots at 46 centres throughout the dairying districts of Southern Victoria. The main purpose of these tests was to determine whether the existing pastures could be still further improved by the use of various artificial fertilizers, or by the sowing of improved strains of grasses and clovers. Although any changes in the pasture resulting from the various treatments have to be studied over a number of years before definite conclusions may be made, much useful information has already been obtained.

The manurial portions of the experiments includes tests with phosphates, potash, nitrogeneous manures, and lime, applied singly and in combination. On most of the plots good responses to the phosphates have already been observed, whilst in some instances further improvement has resulted from the use of lime or sulphate of ammonia. In one or two areas in the Western District increases from potash have been recorded.

A further application of manures was made to all plots during the past autumn, and at the present time the treated strips are generally showing much better growth than are the unmanured strips.

In the areas where grass and clover mixtures and strains have been sown very satisfactory development was made during the first year of growth. The outstanding feature was the excellent establishment of perennial rye-grass. Various strains of this grass are being tested, and good results have been obtained to date with Victorian-grown seed. From these trials it would appear that locally-grown seed is available equal to the best imported rye-grass.

The poorer strains of perennial rye-grass and the annual types made very vigorous growth during the past season. Many of the plants, however, failed to survive throughout the summer, and at present these plots are much inferior to those sown with truly perennial seed.

Cocksfoot has become well established on many plots, and has made surprisingly good growth in several tests in the Western District. Phalaris tuberosa was included in some mixtures, and although early growth was slow, it has since made satisfactory development.

Werribee Red Polls

New Herd Sire

Woodburn Peter Pan.

WITH the object of maintaining the high standard already reached in its stud of Red Poll cattle, at the State Research Farm, Werribee, the Department of Agriculture has acquired a magnificent young bull at a cost of 150 guineas. This young aristocrat, Woodburn Peter Pan (imp. in utero), which was purchased from the New Zealand and Australian Land Co., Bundure, Jerilderie, was bred by the late Hon. T. H. Payne, of "Woodburn," Kilmore, Victoria, from the imported record-producing cow "Marsden Mindful," and by the English sire "Peadowns Pierrot."

Though the 150 gns. paid for this young bull is believed to be the highest price paid in Australia for a Red Poll bull under one year old, the Department of Agriculture regards itself as fortunate in obtaining such a high class animal at that figure, as to import a bull of the same high quality would cost in the vicinity of 500 gns.

Marsden Mindful, the dam of Woodburn Peter Pan, was imported from the Marsden stud of Mrs. M. M. Fitzgerald, Marsden Manor, Circencester, England, a stud noted for its ideal dual purpose characteristics, and particularly high milk production records. Marsden Mindful was purchased by the late Mr. Payne at Mrs. Fitzgerald's dispersal sale, and shortly after landing in Australia, dropped the bull calf "Woodburn Peter Pan." On the lactation that followed she produced 15,672 lb. milk, with an average test of 4.61 per cent. or 723 lb. butter-fat in 273 days. This yield, which was recorded in the Seymour, Broadford, and Kilmore Herd Testing Association under V.U.C.T.A. regulations, constitutes a world's unofficial record for Red Polls in a 273 days' test.

Marsden Mindful had three Marsden mates at Woodburn. All of these have done exceptionally well under test, and one, Marsden Mimulus, was the champion Red Poll cow at the Melbourne Royal Show last year.

The "Victoria" stud of Red Poll cattle was founded in 1909, and between 1909 and 1914, 103 females and four bulls were purchased. These purchases included the imported bulls Longford Major, 10445 (55 AA), bred by the Earl of Radnor, Longford Castle, Salisbury, England, and Belligerent, 11096 (8 AA), bred by Mr. C. F. Newton, Saham Toney, Norfolk, England, and the imported cows Primrose League, 22723 (1 AA), and Velveteen, 22875 (2 AA), bred by the Marchioness of Graham, the present Duchess of Montrose, president of the Red Poll Cattle Breeders Society of Great Britain and Ireland.

At the Melbourne Royal Show the "Victoria" Red Polls have won a large number of prizes, including no fewer than eight championships, six reserve championships, and 30 first prizes for bulls, and seven championships, ten reserve championships, and 49 first prizes for cows, while 106 other prizes have been won, including the Stradbroke Challenge Cup on two occasions, and a second and third prize in the *Weekly Times* champion milk and butter-fat test, open to all breeds.

When the departmental herd was founded, Red Polls as we know them in Australia today did not exist, but by careful breeding and selection the dual-purpose characteristics of the Red Poll in the "Victoria" stud were so

successfully improved that breeders and farmers became intensely interested, and as a result the breed has developed rapidly.

In the breeding of the Werribee Red Polls considerable attention has been paid to the development of the milking function, the average production of the herd in the Standard Herd Test during the last five years being 7,847 lb. milk, with an average test of 4.38 per cent., or 343 lb. butter-fat. With the usual allowances for heifers, the average for the 195 cows tested is 423 lb. butter-fat.

Since 1914 the only additions to the stud have been two cows in 1925, which were later eliminated, and the two bulls, Dominion Bright Belgian in 1929, and Woodburn Peter Pan in 1933. From 1914 on, the Department had been breeding with the four original bulls—Tabacum, Nicotine, Longford Major, and Belligerent, and linebreeding with their descendants, no other outside blood having been introduced until now. In 1929 a bull for outcrossing was needed, but as no suitable outbred bull was available at the time, Dominion Bright Belgian was purchased from the New Zealand Government. This bull is a grandson of the imported bull Gresham Masterful (imp. N.Z.) 12631 (1046 AA), bred by Lieut. Colonel R. C. Batt, Gresham Hall, Norwich, England. All Dominion Bright Belgian's other ancestors are descended from stock exported from the "Victoria" stud to the New Zealand Government in 1918. When buying Dominion Bright Belgian, the Department really bought a bull with 75 per cent. of its own blood, his introduction and use in the "Victoria" stud being what is known as a "climatic outcross."

Prior to the purchase of Woodburn Peter Pan, all the 134 females in the "Victoria" stud were related to the four stud bulls in use. Dominion Bright Belgian had daughters and granddaughters in the stud, and a sire was wanted to mate with these.

Woodburn Peter Pan, the new herd sire, is a well-grown youngster, of good Red Poll type, being dark in colour, and having a good topline, and splendid length in both the body and hindquarters. The facts that he is so well grown and that he carries such good condition reveal his early maturing, good beef producing qualities, while the high production performances of his dam indicate splendid dairy characteristics. Marsden Mindful is a fine type of Red Poll cow, and carries a soft, capacious udder that is developed well forward in front and well upward at the rear. The teats are squarely placed and of convenient size.

The Department of Agriculture hopes that the purchase of Woodburn Peter Pan to head the "Victoria" stud at the State Research Farm, Werribee, will result in an improvement to the already high standards achieved by this stud.

Melilotus in Wheat

The Victorian Millowners' Association has advised the Department of Agriculture that flour-millers in this State have been instructed definitely to refuse to accept delivery of any wheat grown on areas on which Melilotus or Hexham Scent (*Melilotus indica*) is grown, or any wheat in which any trace of the seed of Melilotus can be found. Similar instructions have been given to their wheat agents by members of the Corn Trade Section of the Melbourne Chamber of Commerce. The circular forwarded to millers and wheat agents is as follows:—

Melilotus, also known as Hexham Seed and King Island Clover.

"Merchants and millers have recently had their attention drawn to the fact that the above fodder plant is being grown in some of the wheat-growing districts of Victoria. Agents are advised to warn all farmers growing wheat that they on no account sow melilotus seed, because, owing to its tainting effect, merchants and millers will be compelled to refuse all wheat grown in areas in which melilotus is grown.

"At present the growing of this plant is confined to a very few wheat-growing districts, but should it become a general practice in wheat areas the effect on the exports of wheat and flour from this State will be absolutely disastrous.

Please take notice that you are hereby instructed definitely to refuse to accept delivery of any wheat which is grown on areas on which this melilotus plant is grown, or any wheat in which any trace of the seed can be found."

Export of Fresh Fruit

A Review of the 1933 Season

By J. M. Ward, State Supervising Officer and Superintendent of Horticulture, Victoria.

WITH the departure of the *Jervis Bay* on 8th July, the fresh fruit export season was practically completed, the exceptions being a few light shipments to the East. The past export season was a record one for Victoria. To date, 1,430,220 cases of apples, 390,532 packages of pears and 3,624 half-cases of plums have been exported from this State to the United Kingdom and the Continent. To these must be added 112,802 cases of various fresh fruit shipped to Canada, New Zealand and Eastern countries, making a grand total to date of 1,937,617 packages for the 1932-33 season. The greatest quantity prior to this year was 1,074,550 cases in 1930, of which 889,332 were apples, and 153,455 pears, the balance including some citrus fruit to New Zealand and odd lots of fruit to the East.

Harcourt exported the greatest quantity from any one district in Victoria, i.e., 395,314 cases. No fewer than 57 steamers were used for the conveyance of our apples and pears to England and Europe.

Varieties.

If we are to place the export of fresh fruit on the best possible basis, it is essential that exports be confined to a comparatively few well-known varieties, as it is not good policy to export many more or less commercially unknown kinds of fruit. Victorian exporters of commercial sorts do not want odd lots, but frequently are forced to accept them in order to obtain the more favoured varieties for their principals or overseas representatives. In previous years as many as 61 varieties of apples and 35 varieties of pears have been shipped, while this year the number was increased to 86 varieties of apples and 48 of pears. Normally most of these odd varieties are sold locally, and rarely are more than a

Wrapping Apples for Export.

few cases sent abroad. However, this year an unusually large quantity of pears and apples was exported, and it is probably to this fact that the increase was due.

Types of Cases.

Of the 1,430,216 cases of apples shipped, 512,081 cases (approximately 36 per cent.) were of the dump or Australian type of case, and 918,135 (approximately 64 per cent.) were of the Standard or Canadian type. This shows a decided swing to the use of the softwood Canadian, or Standard as it is now known. Of the 390,532 cases of pears shipped, 82,113 (approximately 21 per cent.) were packed in Standard pear cases (sometimes erroneously called the three-quarter case), the internal dimensions of which are 18 in. x 11½ in. x 8½ in. The remainder were in either dump or long bushel cases. In the 1932 season 28,778 of this type of pear case were shipped (approximately 18 per cent. of the total for that season).

It is interesting to note that last year 1,900 long or flat bushel cases of pears were shipped to Canada, and the fruit, which arrived in excellent condition, made a good impression. A greater demand for Victorian pears consequently was created in that country, but the Canadians desired that the pears should be shipped in the standard pear case; and this year 16,084 cases were shipped to Canada—both East and West, 10,776 of which were Standard pear cases, and 5,308 were flat cases.

Wiring of Cases.

A considerable number of growers shipped softwood dump cases without wiring them. This resulted in many of the cases breaking open in the railway trucks, while being placed in the ship's sling, and later, notwithstanding the fact that the utmost care was exercised in the handling of the cases on the wharfs. All softwood cases, whether dump or Canadian, must be wired or strapped to prevent the nails from springing, and the fruit from falling out of the cases. If growers do not adopt these means to prevent the cases from springing open, they must continue to suffer financially. It costs more to wire and repair cases at the ship's side than it does in the packing shed.

Bruising and Other Defects.

A considerable amount of bruising, most of which was on fruit in the dump cases, occurred also this year. The reason for this usually was that in a large number of instances the fruit was packed much too high in the cases, with the result that when the lid was nailed on the fruit was "dumped" down. The thickness of the timber and the fact that it would not "give" when it was nailed down also caused a considerable amount of bruising. Bruises as large as 1¼ in. in diameter and ¼ in. deep were noticed, and, where detected, all fruit so marked was rejected by inspectors.

Although grade standards have been in force since 1922, there are still many growers who appear to have little or no knowledge of the requirements of the trade or the export regulations. These growers are for the most part located in the older established apple districts. In one instance a grower sent in for export 200 cases of apples packed in excellent Standard cases, bearing a well-known label. The condition of this fruit was disgraceful, and, had it been passed for shipment, would have been a serious reflection, not only on the grower, but on the Australian apple-growing industry as a whole. In another instance 2-in., 2¼-in., 2¾-in., and 3-in. apples were seen in the one case, while, to make matters worse, a large quantity of the fruit was badly marked with black spot. Needless to state, this consignment was instantly rejected.

Details of Rejections.

Reasons for Rejection.	Apples. Cases.	Pears. Cases.
Inferior sizing	6,190	652
Inferior packing	4,058	669
Bitter pit	6,738	—
San Jose scale	2,258	120
Excess spray and inferior fruit	2,853	—
Excess spray, codling, black spot	—	1,019
Codling and black spot	7,380	—
Overripe	1,735	1,844
Inferior cases	1,974	821
Water core and glassiness	148	—
Varieties incorrectly named	118	—
Bruising	212	—
Commerce Act (marks)	1,293	454
Not pre-cooled	—	269
Wet in trucks	94	19
Breakages (railways)	513	37
Breakages (stevedores)	797	79
	36,361	5,983

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Manuring the Orchard.

By F. M. Read, M.Agr.Sc.,
Senior Horticultural Research Officer.

THE application of artificial fertilizers to orchard trees is one of the most general practices in the industry. Nevertheless, there are few subjects upon which there is greater controversy, nor one in which information is more urgently required. In any one district usually can be found growers, on whose orchards similar conditions prevail, using radically different programmes of soil fertilization. Obviously all these growers cannot be using the fertilizers most suitable to their soil, and much money in consequence must be wasted yearly.

It is proposed, in this article, to give technical advice on the choice of fertilizers for application in the spring. Whether it is economical to apply fertilizers or not is a question that can be determined only by the individual grower himself. The use of fertilizers undoubtedly is governed by the monetary return from the trees, and at times prices offering for the fruit may be so low that the value of any increase in yield due to the application of fertilizer may be insufficient to meet the cost of applying that fertilizer.

The use of artificial fertilizers on such perennial crops as fruit trees is designed to fulfil two functions—firstly, to increase the crop, and, secondly, to maintain tree health. But it is questionable if the outlay on fertilizers applied to *vigorous healthy trees* will be recouped by the anticipated increase in crop. It is believed by many that artificial fertilizers applied to *quite healthy trees* will increase the crop, but the results of innumerable experiments throughout the world fail to confirm this view. As a rule it has been found that the unmistakable and general yield increases of such plants as wheat following the use of manures are not experienced in horticulture. On the other hand, it may be a thoroughly sound investment to apply fertilizers of the right kind to trees suffering in health because of a lack of these elements in the soil, even though the crop be not appreciably increased for some years. Where fertilizers further a more healthy growth and appearance in trees previously unsatisfactory in health, they usually improve the yielding capacity of the tree also. When tree health suffers, the grower must apply fertilizers to conserve his main asset.

"Which fertilizer makes fruit?" is a question sometimes asked by growers. In answer it may be said that no fertilizer makes fruit as distinct from growth, but that any one or all of the fertilizers may affect the growth characters of a tree, and thus indirectly affect its yield.

There are very good grounds for believing that if tree growth be satisfactory, yield automatically will be so; from which it would follow logically that growers should decide their manurial practice more upon the appearance of their trees, and less upon the crops they have borne or are expected to bear.

The subject may be viewed from a slightly different angle by asking and answering a further question: "In the event of a shortage of any element is the growth and foliage first affected, or does the yield decline while the tree, to all other appearances remains normal"? The available evidence suggests that the first signs of a mineral deficiency are to be seen in the foliage. Experiments at Upper Beaconsfield on a poor soil which quickly suffers in productivity when fertilizers are withheld have shown that unmanured or improperly manured trees do not make anything like the amount of growth made by those on adjacent manured plots, nor is the appearance of the foliage satisfactory; but during the three years of the trials the yields of the unmanured trees did not decline seriously by comparison, although it is obvious that if faulty growth conditions be allowed to persist they must soon result in low yields.

In England the disease known as Leaf Scorch, which has been associated with potash deficiency, has been extensively studied. It has been found that, in the case of plums, the deficiency is marked in leaves and stems, which, when analysed, are seen to contain very much less potash than normal specimens; but this deficiency is not nearly so marked in the pulp of the fruit, while in the fruit kernel of the affected tree the potash content is practically normal. This is a further indication that when the tree is starved of any particular element—in this case, potash—the leaves and shoots suffer long before the vital organs—the fruit, and seed. This is in accord with the effects accompanying starvation of the animal body, where the vital organs remain perfectly sound until a very late stage in the process of starvation.

This leads again to the very important conclusion previously mentioned that *if the tree is growing in a healthy, vigorous fashion it is a sign that the yield of the tree is not likely to be suffering from a shortage of any mineral, and that conversely the yield of that tree will not be increased materially by applications of fertilizers.*

On the other hand, it points to the necessity for maintaining healthy growth, for only when that is obtained will the tree continue over a period of years to increase its bearing surface, and thus its ability to carry larger and larger crops.

There are orchards on soil quite rich enough to supply the whole mineral needs of the trees, and on such soils growth will be healthy without manure, while the benefit to be secured from fertilizers would be negligible. There are, nevertheless, many soils which will not give the growth desired, and on these the fertilizers suitable to them will prove of inestimable benefit.

There is room for a great deal of experiment, not only in the trying out of fertilizers on orchards previously somewhat neglected, but also on heavily-manured orchards on rich soil, where it would be of great interest to leave some trees entirely unmanured for comparison.

Types of Fertilizers.

The quick-acting inorganic fertilizers are to be preferred in most cases to the organic types which are made available more slowly over a long period.

Nitrogen, in the form of sulphate of ammonia; phosphoric acid, in the form of superphosphate; and potash, in either the sulphate or muriate (except in the saline areas where the muriate should not be used) should supply the needs of most orchards. All of these will not be needed in every case.

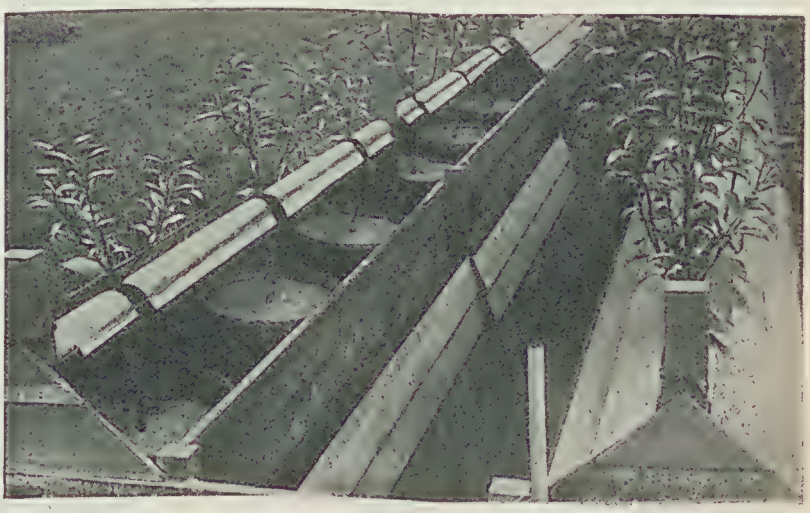

Plate 1.

A general view of the pot experiments in the orchard at Burnley Gardens.

Plate 2.
Potash deficient leaves (front and back) showing the characteristic marginal scorching which usually develops in late Summer.

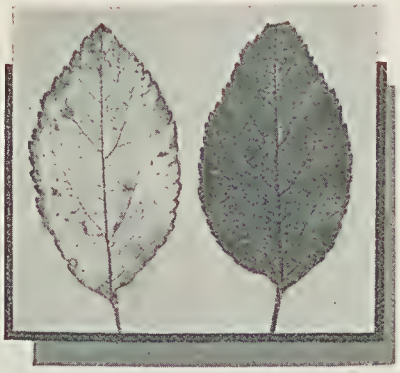

Plate 3.
Nitrogen deficient leaf of yellowish green throughout growing season (right) and bright yellow at defoliation (left).

The following general recommendations are given briefly:—

In particular, the quantities of fertilizer to be applied will vary with tree size.

Deciduous trees in the southern part of the State may be given 2 to 3 lb. per tree of mixed fertilizer containing two parts of sulphate of ammonia, two parts of superphosphate, and one part of sulphate or muriate of potash. This is known under the general name of the 2:2:1 mixture, and is much superior to the older complete horticultural manures.

In the north of the State, particularly the Goulburn Valley, sulphate of ammonia is probably the best spring fertilizer to use. When a grower desires to use a complete fertilizer, the 4:4:1 mixture, i.e., four parts of sulphate of ammonia, four of superphosphate and one of potash, is his best choice. In each case a dressing of 3 lb. per tree would be a reasonable average. Citrus trees should receive sulphate of ammonia at the rate of about 3 lb. per tree in spring, and a similar dressing in autumn.

Young trees are sometimes manured, but it is doubtful if this practice is an economic one. If the ground has been well prepared, and the trees not allowed to suffer from weed competition, they will usually grow normally without fertilizer for the first year.

Pot Experiments on Apple Trees.

During the last two seasons experiments on apple trees grown in 18-in. pots of well-washed sand, and watered with nutrient solutions, have been conducted (see Plate 1). The object of these experiments is to determine the symptoms that develop when each of the principal fertilizing elements in turn is omitted from the diet of trees which receive, with the exception of this one element, a complete plant food.

While it is not intended, at this stage, to discuss in detail the results of these experiments, it may be stated that trees growing under orchard conditions exhibit many of the symptoms developed by the trees in the experimental pots; and it is hoped that the similarity of the symptoms will enable the manurial requirements of apple orchards to be determined from the appearance of the leaves and general growth characters. To the general recommendations given above, the apple-grower therefore may add the following details:— When serious scorching of the margins of the leaves occurs (see Plates 2 and 4), and is not attributable to spray injury, potash alone—up to 3 to 4 lb. per tree—should be given. Dressings of nitrogen should be avoided. Leaf scorch due to a deficiency of potash usually affects the tip leaves of a shoot rather than the basal leaves, and results in premature defoliation of the tips of shoots as seen in Plate 4. Spray injury, on the other hand, usually affects the older basal leaves, subsequent leaf growth being unaffected.

When the leaves of the tree are small, more yellow than is normally the case and bright yellow before defoliation (see Plates 3 and 5), and when length growth is scanty, and the bark reddish and unhealthy nitrogen—as sulphate of ammonia—should be applied alone at the rate of 2 to 3 lb. per tree, for a few years.

Applying the Fertilizer.

For maximum effectiveness, fertilizers should be applied to deciduous trees two to three weeks before bud burst each spring. Evergreen trees such as citrus should receive a spring and autumn dressing—in each case, just prior to the growth period.

The effectiveness of a manurial dressing may be influenced greatly by the method of application. It is certain that much of the material broadcast on the surface never reaches

the tree's root zone, some being absorbed by the roots of surface plants, and some held by the top layer of soil and rendered relatively unavailable to the trees.

It is imperative that the fertilizers be introduced into the actual root zone of the trees, preferably by spreading on the surface and then ploughing under.

Another method is to plough a single deep furrow on either side of the row of trees, and place the manure deeply in this furrow; but a somewhat better plan, though not so rapid, is to furrow out as described above, and then cross-furrow in the same way, providing a furrow for the manure right round the tree.

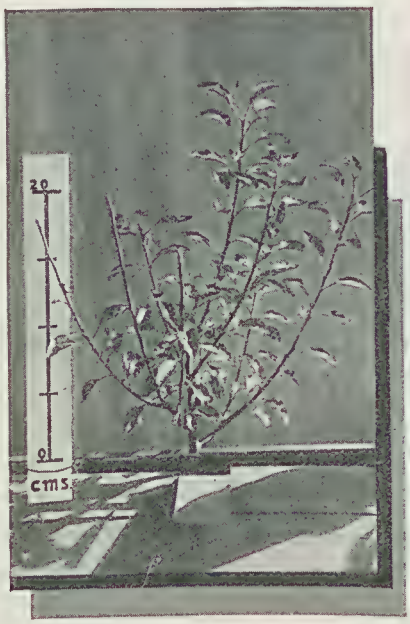

Plate 4.
Potash deficient tree showing defoliation of *tips* of affected shoots.

Plate 5.
Nitrogen deficient tree showing very reduced growth and defoliation commencing at *base* of the tree.

It is probable that many of the failures to obtain results with fertilizers on fruit trees are due to the lack of proper methods of application, and experiments along these lines are at present very necessary. It is even possible that in the future such compounds will be forced deep into the soil by means of specially-constructed power units.

Export of Fresh Fruit

(*Continued from page* 376.)

The records show that 36,361 cases of apples and 5,983 cases of pears were rejected for various reasons; but, in addition to these quantities, several thousands of cases, of which no record was kept, were rejected at packing sheds and on orchards. Black spot markings were responsible for the rejection of 8,000 cases of apples and 1,000 cases of pears, while 3,000 cases were rejected on account of having excessive spray markings. Fruit was rejected also for other reasons, such as codling moth, slack packing, bitter pit, hail marks, &c.

The inspection of the fruit submitted was probably more rigid than hitherto. Bitter pit, however, is in Victorian apples apparently more prevalent in the apples on arrival in England than in the past. This trouble developed after the fruit was shipped. Pit is rarely found in the Dunn's variety of apple, yet this year it was very subject to the trouble. No apples showing signs of pit at Melbourne were passed for export.

Brown Rot in Peaches

Goulburn Valley Fruit in Sydney

By S. Fish, M.Agr.Sc., Assistant Plant Pathologist

THE Sydney peach market offers a profitable outlet for market varieties of peaches grown in the Goulburn Valley, provided that the peaches reach the market in a firm sound condition, and remain sound for a period of about five days from arrival. Usually about 170,000 cases of peaches are sent from the Goulburn Valley, but approximately 107,000 cases were sent last season. Gluts, due to an over-supply of firm, choice peaches, have not occurred, at least not during the last ten years. There may have been congested market at times when the fruit arrived in an over-ripe condition, or where it showed deterioration from other causes, but this state of affairs has been partly eliminated where the practice of pre-cooling and ice-trucking of fruit is adopted. Firm, sound peaches may be cool-stored in Sydney, and thus congested week-end supplies may be properly regulated.

It is the general opinion of the agents and of Mr. D. G. Wills, market representative of the Goulburn Valley growers at Sydney, that the limits of this market have never been exploited, because at no time has there been sufficient firm, sound, choice fruit sent across to test it out. It is stated by the trade that in a normal year only about 25 per cent. of Goulburn Valley fruit could be considered choice. By this is meant peaches picked at the right stage of maturity, carefully graded, and packed in a satisfactory manner.

The Murrumbidgee area of N.S.W. has planted almost purely canning peaches, and cannot be considered as a serious competitor of Goulburn Valley growers, either at the present, or, apparently, in the future. Growers in this area send to the Sydney market Elberta peaches, which arrive about ten days before Goulburn Valley Elbertas. They send, also, those Pullar's Cling peaches which are too small for canning purposes. Apart from these two varieties, practically no peaches are sent.

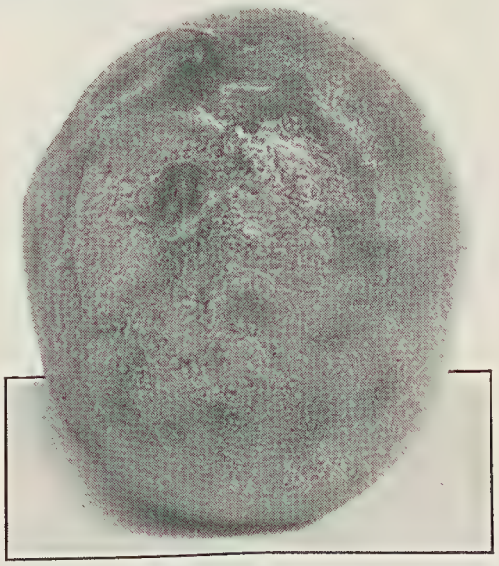

Plate 1.—Peach infected by Brown Rot.

The first variety of peach to reach Sydney market from the Goulburn Valley is Hales, and these are followed closely by Zerbes, which are on the increase from year to year. These peaches come on a clear market, and if in a sound condition, will sell readily at 10s. to 12s. per case, or more. The Elberta peaches then follow, and, provided that the grower does not send them too immature, they will ripen up without the presence of the bitter flavour which develops in Elberta peaches picked too green. This variety clashes to some extent with the New South Wales Elbertas, but not to a serious degree. For instance, 5,000 bushels of Goulburn Valley Elbertas would arrive with about 1,000 bushels of Elbertas from the New South Wales areas. The Nicol's Orange Cling peach then comes forward for about two weeks. These are followed by Palmerston, Sims, and

Goodman's Choice varieties. The two last-mentioned varieties have a very short life, and become over-ripe very quickly. They are very poor market varieties. Pullar's Cling peaches follow. This peach has a reputation of being a good carrier. In past seasons up to 10,000 cases of this variety have been shipped from Sydney to Darwin and other northern ports. This trade has never been properly exploited.

Enough has been said to indicate the possibility of the Sydney market for Goulburn Valley fruit, provided that firm, sound peaches of good quality are sent, and provided, also, that their life is not prematurely shortened by the onset of Brown Rot.

During last season, unfortunately, there was a very severe outbreak of Brown Rot, and a large proportion of the 107,000 cases of peaches sent from the Goulburn Valley to Sydney developed this disease during the journey, and were showing serious damage with this disease on their arrival at the market.

Peaches which were pre-cooled and forwarded under cool transport conditions sometimes showed only slight Brown Rot infection on arrival, but when the cooled fruit was exposed to the prevailing temperatures of the market, the disease developed rapidly. This occurred when the peaches were in the hands of the agents, buyers, and consumers. This state of affairs eliminated the operations of the better type of buyers, who generally operate on about 45 per cent. of the peaches, and this fruit was "thrown back" on to the poorer buyers, who obtained it at their own prices.

In order to arrive at a fairly accurate estimate of the losses caused by Brown Rot last season at the Sydney market, a detailed examination was made of the prices received for all consignments of peaches received throughout the season by an agent who handled 8,000 cases. This showed 4s. 6d. per case to be the average obtained, and this figure could be accepted as a reliable estimate of the average return to the agents of the whole of the Goulburn Valley peaches sold in Sydney last season.

Production Costs.

The cost of production of peaches was investigated in detail by the Development and Migration Commission, and in the report relating to the canned fruits industry of Australia, published in 1929, it was stated that, to meet costs of production and allow the grower a reasonable margin, a return of £9 10s. per ton for canning peaches was necessary.

The cost of production of true market varieties, such as Highs Early or Zerbe, is considerably higher than that of canning peach varieties, because the yield of the former is substantially lower than that of the latter.

Leading growers compute their costs of production of white flesh market varieties at about £12 per ton, and Elbertas and Nichols at about £10. Considering the peach varieties sent to the Sydney market throughout the season, the average cost of production, on a conservative basis, could be put down at approximately £10 10s. per ton.

The costs against a one-bushel case of peaches on its arrival at the agent's stand are as follow:—

	s.	*d.*
Cost of production, £10 10s. (50 bushel-cases per ton)	4	3
Cost of case, picking, grading, carting	2	0
Freight and handling charges ..	1	9
Commission, 7½ per cent., with minimum charge of 6d. ..	0	6
	8	6
Average price obtained per case by agent	4	6
Loss per case	4	0

Thus the sending of 107,000 cases of peaches to the Sydney market last season resulted in a loss to the Goulburn Valley growers of about £20,000. This severe loss was due entirely to Brown Rot.

Development of Brown Rot.

With the object of analysing the position, an experimental investigation was initiated on the factors which determine the development of Brown Rot in peaches, which were forwarded to the market under cool transport conditions. In this article it is proposed to discuss briefly certain points of practical importance which were the outcome of last season's work.

In every case the Brown Rot infection which developed during cool transport could be traced to some definite injury which the peaches had received at the orchard. This observed fact was verified experimentally by actually inoculating peaches in standard injuries prior to transport. The time taken to initiate Brown Rot was found to vary according to the delay between picking and pre-cooling.

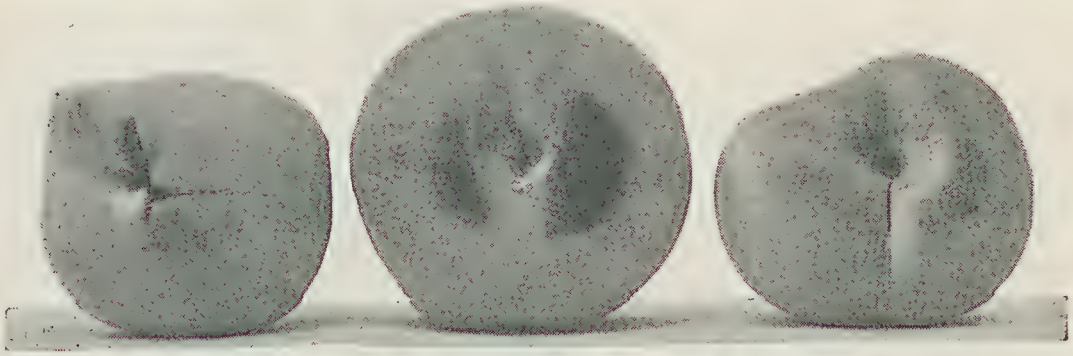

Plate 2.—Typical injuries received through faulty packing.

It is thus obvious that every care should be taken to discard any peaches at the packing table which show any visible injury.

The Brown Rot development which occurred after the cooled fruit was exposed to the prevailing market temperatures was of a two-fold nature as regards the origin of the infection—(*a*) that which occurred in any injuries which the peaches had received during transport, and (*b*) that which occurred through the uninjured skin of the peach when over-ripe.

The injuries which are produced during transport are caused by faulty packing of the peaches, and to the vibration incidental to the 500-mile journey to the market. The injuries observed were caused by the pressure of the peaches against each other and against the sides of the case. This pressure caused a slight injury or split to the skin in the "crease" of the peach. (See plate 2.) In some cases examined it was found that 25 per cent. of the peaches were injured in this way.

The Brown Rot development which occurred in such injuries was comparable to that obtained by artificially inoculating peaches on their arrival at the market.

To minimize this type of infection steps should be taken to utilize all the means available to prevent this class of injury. The use of corrugated board lining for the case would be very helpful.

The Brown Rot infection which occurred in uninjured peaches when they were nearing the end of their natural life is important, since, if the remaining life of the peach on reaching market is short, this type of infection may occur before the peaches are consumed. To permit the operations of the best type of buyers—the country forwarding agents—peaches must remain sound for a period of about five days when held at ordinary ripening temperatures. By that time they are generally consumed.

The time of initiation of this Brown Rot infection varies with two factors—the stage of maturity of the peaches on arrival, and the

(Continued on page 387.)

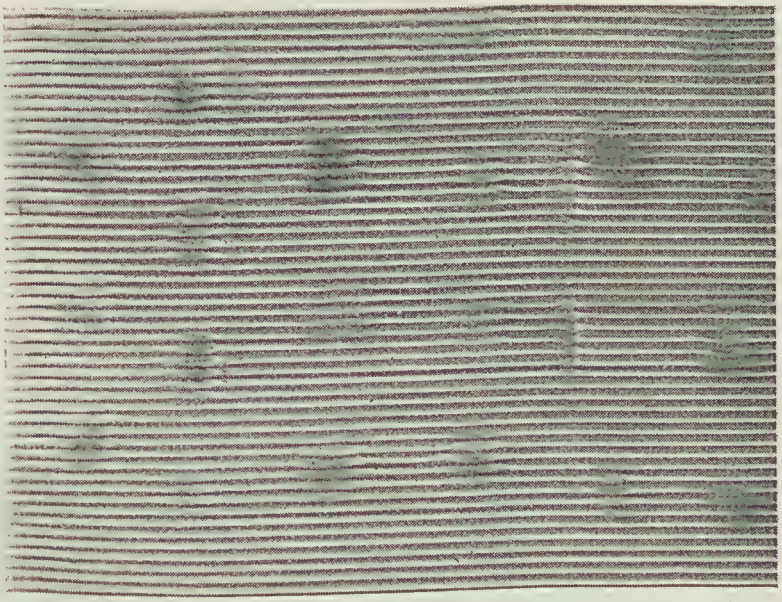

Plate 3.—Showing how a light, corrugated board lining accommodates itself to the pressure exerted by peaches against the side of the case.

Winter and Spring Injury to Deciduous Fruit Trees

By A. G. Strickland, M.Agr.Sc., Horticultural Research Officer.

Affected Peach Trees at Shepparton.

FRUIT tree injuries that occur during winter and early spring, in Victoria, are caused chiefly by excessive rainfall, which brings about waterlogging of the soil, or by low temperatures, which injure or kill blossoms and young fruits.

Trees growing on land which is subject to a high water table may thrive satisfactorily for a time, but in an exceptionally wet winter they are liable to become waterlogged, and in many instances die as a result. The effects of waterlogging on deciduous fruit trees are due primarily to diminished aeration of the roots. Submergence of the roots in water cuts off their air supply, and the usual result is prompt killing of the root hairs, followed more or less closely by the death of the roots themselves. Some orchards have badly drained areas which are subject to waterlogging, and on these the bad soil conditions are reflected in the poor vigour of the trees, which, though they may continue to live, are never fully fruitful. Moreover, in a particularly wet winter, trees which are subject to mild waterlogging in normal seasons may be drowned completely.

The disastrous effect of abnormally high rainfall during the winter months was illustrated by the huge losses of deciduous fruit trees which occurred throughout Victoria during the winter and spring of 1931. In most instances these losses were due to a condition known as "sour sap," which very often follows on the drowning of tree roots. As a general rule, peaches and apricots are more susceptible to wet feet than either pears or apples, and in 1931 approximately 14 per cent. of the total peach acreage in the Shepparton district was wiped out.

"Sour sap" is characterized by defoliation early in spring, or by a total failure to leaf. The bark of limbs, trunks, and roots often shows a brownish staining, which extends into the wood for some distance. On cutting the bark of affected trees, a very sour odour, suggestive of fermentation, is noticeable—hence the name "sour sap." The ultimate effect of the waterlogging is concerned with the killing of roots, internal gumming of the tree, and the consequent inability of the tree to obtain food and water from the soil. Sour sap was not confined to the Goulburn Valley in 1931, though it was most disastrous there, possibly owing to the influence of late autumn irrigations. Rainfall cannot be controlled by man, but it is not impossible to prevent an excessive rainfall from causing the losses which it did in 1931.

In irrigation districts, over-watering in summer and autumn undoubtedly combined with the winter rain to accentuate waterlogging. Every irrigator should possess a soil auger, and understand the importance of regular soil sampling in determining irrigation requirements. Long irrigation runs should be avoided, as under such conditions the top portion of the run must be over-watered in order to give sufficient to the portions farthest from the head ditch.

Where the water table is injuriously high, good tile drainage may save the life of trees in exceptional years. Some soils, however, and

this is generally the case in many northern irrigation districts, are so tenacious and resistant to percolation that tile drainage is not effective enough to be profitable. In such cases, surface drainage is imperative during a wet winter. The annual growth of a winter green crop is also of great value in ridding the soil of excess water. Experiments at Tresco have shown that a crop of peas and beans removes during its growth tremendous quantities of soil water by transpiration. It is sound orchard practice to plant a winter green crop wherever practicable.

Effects of Low Temperatures.

Our comparatively mild winter climate renders us safe from the severe winter frosts or "freezes" which, in many less favoured climes, may kill trees even in midwinter. In parts of America, and on the continent of Europe, extremely low winter temperatures result in such injuries as root-killing through freezing, bark and trunk splitting, killing back of branches, and killing of fruit and leaf buds. During the winter of 1928-29, temperatures as low as 46 deg. below freezing point were experienced in Central Europe, and large areas of apples, pears, plums, peaches, &c., were completely killed. In Canada and parts of the United States the ability of tree fruits to withstand low winter temperatures is of tremendous importance.

Fortunately, we are not faced with the problem of such rigorous winters, but in common with many other regions we must consider the question of spring frosts. In parts of Victoria, particularly inland, severe spring frosts during October and November may cause serious damage to fruit blossom or young fruits, with the consequent destruction of all or part of the season's crop. Anything that can be done to prevent or reduce such damage is worthy of consideration, even though the frosts may not be of yearly occurrence.

Quite apart from the killing of blossoms or young fruits by frost, moderately low temperatures during flowering will adversely affect the set of fruit. Most fruit blossoms are dependent on pollination for fruit setting, and this requires the germination of pollen grains on the stigma of blossoms. It has been shown that pollen grains will not germinate at low temperatures; or, if they do, the growth of the pollen tube is so slow that fertilization does not take place. Long spells of cold and wet weather, during which the temperature is below 40° or 50° F., are quite unfavorable for fruit-setting, and though no actual killing of blossoms may occur, these conditions will result in a poor set of fruit. In addition, low temperatures are unfavorable to the flight of bees, and, therefore, prevent the cross-pollination which is so necessary for good setting of most fruit varieties.

Tree affected with "sour sap," showing typical staining of bark.

Frosts are caused by loss of heat from the earth's surface during the night. When this loss of heat is very rapid, the temperature of the soil surface may fall to freezing point, i.e., 32° F., or lower. Certain atmospheric conditions are essential for this rapid loss of heat from the earth's surface. Clouds reflect heat that is radiated from the soil, and, therefore, cloudy nights, though still, are not likely to be frosty. A fair breeze does not prevent the loss of heat from the earth's surface, but it mixes the air and prevents excessive cooling of any small portion of it. In consequence, windy nights are not likely to be frosty. The clear windless nights are dangerous.

On a frosty night, dew is deposited from the atmosphere, and is subsequently frozen into white hoar frost. Such white frosts are seldom very severe, owing to the fact that some heat is liberated in the process of dew formation and its transformation into hoar frost. When the

A dead Peach tree at Shepparton, showing "sour-sap" condition.

atmosphere is so dry, however, that there is insufficient moisture to condense as dew, and subsequently freeze into hoar frost, we have what is called a black frost. If other conditions favour rapid loss of heat from the earth's surface, there is nothing to prevent the steady fall of temperature to a very low point, without the formation of visible frost. Such black frosts are frequently very destructive.

Frosts are less usual in areas close to large bodies of water, and hillsides are generally less subject to frost than low-lying flats. Cold air is heavier than warm air, and tends to sink into hollows on the earth's surface—hence the danger in valleys and depressions. In selecting a site for an orchard, low-lying areas subject to frost should be avoided.

Several direct means of combating frost have been tried with variable success; these include the use of smoke-screens, or smudges, as they are sometimes termed; spraying the trees with water; and direct heating with fires or oil-burners. Smoke screens are used with the object of preventing the escape of heat from the earth's surface—in fact, the smoke is intended to serve the same purpose as does a blanket for human beings. The use of smoke screens is of long standing, and was carried out by the early Romans. Recent experiments have shown, however, that there is nothing to indicate that a sufficient saving of heat takes place to make the smoke screen of much value. The fires used to provide the smoke do, of course, give off some direct heat. These results are surprising, seeing that the practice of smudging has been in vogue for so many centuries.

Efforts to protect plants by a water spray have not been successful. It has been shown that, other things being equal, sprayed blossoms are more severely damaged owing to the formation of ice on the surfaces of the blossom.

While investigating the effect of smudging, it was found that the fires used for producing smoked warmed the air in their vicinity. Consequently, the use of fires or burners for direct heating was tried, and found to be successful. In California, where orchard heating is practised extensively, oil-burners are used generally at the rate of about 100 burners per acre. These burners have the advantage of being quickly lighted and readily extinguished when danger is past. Fires of coal, coke, briquettes, wood, &c., often take too long to light, and are not readily put out, with the result that fuel may be unnecessarily wasted. No figures of experiments in Australia are available to show the cost of orchard heating, but it is apparent from a study of American figures that the practice is costly. Whether it is profitable seems to be a debatable point. If the value of the crop is high, heating may be economically sound; if the crop value is low, heating is of doubtful wisdom.

The use of oil-burners is probably out of the question in Victoria, but there is no doubt that some provision for heating should be made in certain localities which are subject to heavy frosts. Piles of wood, rubbish, or anything which will burn could be distributed throughout the orchard during the winter, ready to be used in spring should exceptional frosts occur. In this matter it should be remembered that, from a heating viewpoint, many small fires are infinitely superior to a smaller number of large fires. Usually when damage occurs in our orchards, it is the effect of one particularly severe frost occurring during the blossoming, or whilst fruits are small, and it seems likely that the expenditure of time and labour during the winter months in gathering and distributing fuel in most cases would be amply repaid should a serious frost occur. There are many progressive growers who do provide for that possible frost, and the writer

has seen the effect of the fires in saving crops from total destruction. Damage is more likely in the low-lying portions of an orchard, and any provision for heating should be made first for these low-lying areas.

Having made provision for heating, the grower's next concern is, when the fires should be lighted. Frost prediction is not only possible, but a comparatively simple matter. It is not practicable to give here a full description of the exact procedure, but the subject is fully treated in a circular which is available on application to the Department of Agriculture. The A Class wireless broadcasting stations and some B Class stations broadcast frost warnings during the danger periods. These warnings are broadcast by both 3LO and 3AR, together with the weather reports from August to mid-September for apricot and peach growers; and from mid-September to the end of October for pear and apple growers.

Frost warnings will tell the orchardist when to expect trouble, and, guided by a thermometer, he lights the fires when the temperature approaches the danger mark. At 32° F. (freezing point) little damage occurs, but when the temperature continues to fall below this point and approaches 28° or 29°, blossoms are likely to be injured.

Warnings are of use only to growers who previously have made some provision for the rapid lighting of fires throughout the danger spots of their orchard. With no such provision, the knowledge that severe frosts are expected is of no practical help. The distribution of fuel throughout orchards occasionally subject to heavy frosts is an insurance. If the spring passes without a serious frost, the cost of fuel and distribution must be regarded as a loss, but in the event of a severe frost, the greater part of the fruit crop may be saved.

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Brown Rot in Peaches

(*Continued from page* 383.)

spore dosage on the surface of the peaches. The spore dosage on the peaches apparently varies from orchard to orchard and from year to year. Until last season little trouble was experienced with Brown Rot development in peaches which were pre-cooled and forwarded to Sydney under cool transport conditions, even though the Brown Rot disease was present to some extent each year in a number of the orchards in the Goulburn Valley. Last year, however, Brown Rot assumed epidemic proportions at blossoming time, and the spores were carried through on to the maturing fruit. It was the most severe outbreak yet experienced in this area.

Definite experimental evidence obtained proved that the heavier the spore dosage or load on the surface of sound peaches, the shorter is the infection period and the higher the percentage of peaches infected with Brown Rot in a given time. It was shown, also, that the more mature the peaches the higher the percentage of Brown Rot infected peaches in a given time.

In order to provide for the maximum peach life at market temperatures, so that the onset of Brown Rot will be delayed sufficiently long to permit consumption, attention should be given to the following points:—

(*a*) Pick the peaches at the correct stage of immaturity compatible with market requirements;

(*b*) reduce as far as is practicable the delay between picking and pre-cooling;

(*c*) pre-cool the peaches to 32 deg. F., and forward in refrigerated cars *throughout the whole of the journey.*

In order to reduce the Brown Rot spore concentration on the surface of sound peaches at the orchard, the present available methods which are known to cause some reduction in Brown Rot fruit infection should be practised, such as the destruction at pruning time of dried diseased fruits ("mummies") and infected twigs. This should be supplemented, apart from the usual Bordeaux mixture applied for peach curl control, by fruit protection spraying with lime-sulphur or ammonium polysulphide. The latter spray may be applied very close to picking without leaving a noticeable spray deposit.

Every effort should be made during the picking, grading, and packing operations to prevent the contamination of sound peaches by contact, direct or indirect, with infected fruit.

Manurial Trials on Potatoes

Results for 1932-1933

By J. T. Ramsay, Potato Expert.

DESPITE the widely varying growing conditions experienced during the past season in those parts of the State where potato manurial trials were conducted, the results again demonstrate the benefit of judicious crop manuring. The districts covered represent practically all the more important potato-growing districts and include a wide range of soils and climatic conditions.

KOROIT.

The yields obtained at Southern Cross, in the Koroit district, are among the heaviest for the year. While they do not show any very marked difference between the manured and unmanured plots, they do provide a striking example of how even rich land can be improved by the practice of green manuring.

The history of this field for the past four years is as follows:—1929-30, flax ploughed under; 1930-31, potatoes; 1931-32, peas ploughed under; 1932-33, potatoes. This season's heavy crop from the unmanured sections may be attributed largely to this green manuring treatment. The field in which the plots are located consists of a black volcanic soil.

The results at Koroit for last year and the average yields obtained over the last four years are set out in Tables I. and II.

TABLE I.—POTATO MANURIAL TRIALS, KOROIT, 1932–33.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	9 15	0 5	2
Super., 3 cwt. ..	10 15	1 5	13
Super., 4 cwt. ..	10 7	0 17	9
No manure	9 10	..	..
Super., 3 cwt. + amm. sulp., 1 cwt. ..	10 15	1 5	13
Market garden, 3 cwt. ..	10 15	1 5	13
Basic phosphate, 3 cwt.	9 15	0 5	2
Super., 3 cwt. + amm. sulp., 2 cwt. ..	11 0	1 10	16

TABLE II.—AVERAGE RESULTS, KOROIT FOR FOUR YEARS, 1928–29 TO 1932–33.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	7 4	21
Super., 3 cwt.	7 6	22
Super., 4 cwt.	7 6	22
No manure	5 19	..
Super, 3 cwt. + amm. sulp., 1 cwt.	7 16	31
Market garden, 3 cwt.	7 5	22
Basic phosphate, 3 cwt. ..	6 17	15
Super., 3 cwt. + amm. sulp., 2 cwt.	11 0*	16*

* One year only.

While the increases from manures last season were not so great as in previous years, they were still significant and depress but slightly the average for four years as compared with that for three years. Notwithstanding the fact that this soil is amongst the richest in the State, it has shown an appreciable response to manure—particularly the "3 and 1" mixture—in each of the four years in which tests have been made.

MUSK.

The returns at Musk, on the Daylesford-Woodend line show much wider differences between the manured and unmanured sections, the greatest increase for the year being that from a new dressing of 3 cwt. super. x 2 cwt. ammonium sulphate per acre. This is the first occasion on which the heavier dressing of nitrogenous fertilizer has been applied generally to the plots, and it has given marked results in practically all districts.

The returns at Musk for the past season show highly satisfactory increases from the various manures as against the yield from the unmanured plots which averaged 3 tons 10 cwt. to the acre. The greatest increase was obtained from the application of 3 cwt. super. and 2 cwt. ammonium sulphate, the yield on the plot so treated being 6 tons 3 cwt. per acre,

or 76 per cent. more than that from the unmanured plot. The "3 and 1" dressing gave a 57 per cent. increase, and the market garden manure 53 per cent. (see Table III.).

Table IV., setting out the averages at Musk for the past five years, shows the "3 and 1" mixture to be well ahead of the others with an average increase of no less than 61 per cent. over that period.

These plots are located on a light-red volcanic soil.

A crop of selected "Up-to-Dates" at Beech Forest.

TABLE III.—POTATO MANURIAL TESTS, MUSK, 1932–33.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	4 8	0 18	26
Super., 3 cwt. ..	4 16	1 6	37
Super., 4 cwt. ..	4 16	1 6	37
No manure	3 10	..	..
Super., 3 cwt. + amm. sulp., 1 cwt. ..	5 10	2 0	57
Market garden, 3 cwt. ..	5 7	1 17	53
Basic phosphate, 3 cwt.	4 5	0 15	21
Super., 3 cwt. + amm. sulp., 2 cwt. ..	6 3	2 13	76

TABLE IV.—AVERAGE RESULTS, MUSK, FOR FIVE YEARS, 1928–29 TO 1932–33.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	3 19	21
Super., 3 cwt.	4 6	32
Super., 4 cwt.	4 11	40
No manure	3 5	..
Super., 3 cwt. + amm. sulp., 1 cwt.	5 5	61
Market garden, 3 cwt.	4 12	41
Basic phosphate, 3 cwt. ..	4 2	26
Super., 3 cwt. + amm. sulp., 2 cwt.	6 3*	75*

* One year only.

At Musk, Mr. E. Bull, on whose farm the experiments were carried out, made an interesting test of different methods of planting. This work was done by two types of mechanical planters, one being the ordinary self-contained planting machine which opens the furrow, sows the seed and manure, and closes the furrow in one operation. The second type of planter was that attached to a three-furrow plow which actually ploughs the ground and at the same time sows the seed and manure. The soil in both cases was the same and in the same condition, as were also the seed and rate of manure. The resulting crop showed in favour of the plowing type of planting machine to the extent of over 1 ton per acre.

BEECH FOREST.

Climatic and soil conditions at Beech Forest differ from those obtaining at other centres where these trials are conducted. The average rainfall at Beech Forest is about 70 inches, and on this account a wider range of weights of manures is applied, the dressings varying from 6 cwt. up to 11 cwt. of a compound manure per acre.

This is only the second year in which manurial tests have been made in this district, where the soil for the most part is a rich friable loam, from grey to black. It responds readily to manuring and very marked increases have been obtained in each of the two years.

Last season the greatest increase was obtained from the dressing of 9 cwt. super. and 2 cwt. ammonium sulphate, which increased the yield from 4 tons 10 cwt. (no manure) to 8 tons 4 cwt., or 82 per cent. The next best was the 6 cwt. super. and 2 cwt. ammonium sulphate dressing, which gave a 72 per cent. better yield than the "no manure" plot. The "6 and 1" mixture increased the yield by 67 per cent. Because of the added cost it is

questionable whether the dressings heavier than the "6 and 1" would be profitable except in a year of high prices.

TABLE V.—POTATO MANURIAL TESTS, BEECH FOREST, 1932–33.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 6 cwt. ..	4 15	0 5	5
Super., 9 cwt. ..	5 19	1 9	32
Super., 6 cwt. + amm. sulp., 1 cwt. ..	7 10	3 0	67
Super., 6 cwt. + amm. sulp., 2 cwt. ..	7 15	3 5	72
Super., 9 cwt. ± amm. sulp., 1 cwt. ..	6 18	2 8	53
Super., 9 cwt. + amm. sulp., 2 cwt. ..	8 4	3 14	82
Super., 6 cwt. + amm. sulp., 1 cwt., pot. sulp., 1 cwt. ..	6 9	1 19	43
No manure	4 10	..	..
Colac blood and bone, 6 cwt.	5 15	1 5	28

The past season was unusually dry for this district, and as a consequence the yields were very much lighter than in the previous year, when the heaviest plot ("9 and 2") gave a yield of 12 tons 14 cwt. per acre, and the "6 and 1" plot 10 tons 15 cwt. per acre. Because of this, Table VI., giving the average results for the two years' operations, shows only moderate yields, though the percentage increases are still very striking, the "9 and 2" mixture giving an average increase of 132 per cent. and the "6 and 1" mixture 102 per cent. increase. As this district is becoming increasingly important as a potato-producing area, these figures should be of considerable interest to growers.

TABLE VI.—AVERAGE RESULTS, BEECH FOREST, FOR TWO YEARS, 1931–32 AND 1932–33.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 6 cwt.	6 5	39
Super., 9 cwt.	7 7	63
Super., 6 cwt. + amm. sulp., 1 cwt.	9 2	102
Super., 6 cwt. + amm. sulp., 2 cwt.	9 6	107
Super., 9 cwt. + amm. sulp., 1 cwt.	9 12	113
Super., 9 cwt. + amm. sulp., 2 cwt.	10 9	132
Super., 6 cwt. + amm. sulp., 1 cwt., pot. sulp., 1 cwt.	8 13	92
No manure	4 10	..
Colac blood and bone, 6 cwt. ..	6 5	39

ROMSEY.

At Romsey the increases in yields obtained from the various manurial treatments were again amongst the smallest recorded over the whole of the experiments. The weather during the season was not conducive to high yields, but it is a fact that the red volcanic soil of this district, for some obscure reason, does not respond to manurial treatment to a degree comparable to that in other districts with quite similar soil and climate.

Super. applied alone during the past season, at the rates of 2, 3, and 4 cwt. per acre, respectively, failed to produce any appreciable result.

The "3 and 1" super. and ammonium sulphate mixture showed a modest improvement of 19 per cent., while the plot treated with the "3 and 2" mixture gave a yield 1 ton

Experimental Plots at Beech Forest.

The plot on the left received no fertilizer, while that on the right was treated with 6 cwt. of superphosphate and 1 cwt. of ammonium sulphate per acre.

16 cwt. better than the unmanured plot, an increase of 36 per cent. It will be interesting to see whether this benefit from the additional 1 cwt. of ammonium sulphate is maintained in subsequent seasons.

Notwithstanding the moderate increases obtained from the manured plots at Romsey, the average returns over the five years in which these experiments have been carried on show that certain manurial combinations are definitely beneficial and profitable, though not to the same extent as is the case in other parts of the State.

TABLE VII.—POTATO MANURIAL TRIALS, ROMSEY, 1932–33.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	5 0	..	..
Super., 3 cwt. ..	5 0	..	..
Super., 4 cwt. ..	5 4	0 4	4
No manure	5 0	..	..
Super., 3 cwt. + amm. sulp., 1 cwt. ..	5 19	0 19	19
Super., 3 cwt. + amm. sulp., 2 cwt. ..	6 16	1 16	36
Market garden, 3 cwt. ..	5 13	0 13	13
Basic phosphate, 3 cwt.	5 0	..	..

TABLE VIII.—AVERAGE RESULTS, ROMSEY, FOR FIVE YEARS, 1928–29 TO 1932–33.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	5 10	15
Super., 3 cwt.	6 2	28
Super., 4 cwt.	5 11	16
No manure	4 15	..
Super., 3 cwt. + amm. sulp., 1 cwt.	6 4	30
Market garden, 3 cwt.	5 13	19
Basic phosphate, 3 cwt. ..	5 9	14
Super., 3 cwt. + amm. sulp., 2 cwt.	6 16*	36*

* One year only.

The two outstanding dressings (on the basis of five years' results) are (*a*) 3 cwt. super. per acre (average increase 28 per cent.), and (*b*) the "3 and 1" application (increase of 30 per cent.). The "3 and 2" super. and ammonia mixture gave an increase of 36 per cent. last season, but as that return is for one year only it cannot yet be compared with the results of treatments which have been tested over the longer period.

TRENTHAM EAST.

Owing to the adverse seasonal conditions the yields of potatoes from the experimental plots on the red volcanic loam at Trentham East were very light, and, as is generally the case under such circumstances, the percentage increases due to the fertilizers were abnormally high. A feature of the results was the appreciable effect shown by the heavier application of sulphate of ammonia, the "3 and 2" dressing giving a 25 per cent. greater yield than the "3 and 1." This latter application (3 cwt. super. and 1 cwt. of sulphate of ammonia per acre) has given an average increase of no less than 122 per cent. over the last six years. The next highest increase (94 per cent.) was recorded by the plot treated with superphosphate alone at the rate of 3 cwt. per acre. The results for last year and the averages for the six years in which these plots have been conducted are set out in Tables IX. and X.

TABLE IX.—POTATO MANURIAL TESTS, TRENTHAM EAST, 1932–33.

Manure per Acre.	Weight Marketable Tubers.	Increase due to Manure.	Percentage Increase.
	T. C.	T. C.	%
Super., 2 cwt. ..	1 18	0 18	90
Super., 3 cwt. ..	2 0	1 0	100
Super., 4 cwt. ..	2 0	1 0	100
No manure	1 0	..	..
Super., 3 cwt. + amm. sulp., 1 cwt. ..	3 0	2 0	200
Market garden, 3 cwt. ..	2 0	1 0	100
Basic phosphate, 3 cwt.	1 18	0 18	90
Super., 3 cwt. + amm. sulp., 2 cwt. ..	4 0	3 0	300

TABLE X.—AVERAGE RESULTS, TRENTHAM EAST, FOR SIX YEARS, 1927–28 TO 1932–33.

Manure per Acre.	Average Yield.	Percentage Increase.
	T. C.	%
Super., 2 cwt.	4 12	70
Super., 3 cwt.	5 5	94
Super., 4 cwt.	5 2	89
No manure	2 14	..
Super., 3 cwt. + amm. sulp., 1 cwt.	6 0	122
Market garden, 3 cwt.	4 11	68
Basic phosphate, 3 cwt. ..	4 8	63
Super., 3 cwt. + amm. sulp., 2 cwt.	4 0*	300*

* One year only.

Small Wool Clips

Advantages of Bulk Classing

By N. A. Bowman, Sheep and Wool Expert

GRADING and classing of primary products are essential requirements for successful marketing, and most of our rural industries are now efficiently controlled by sound regulations, which ensure produce being marketed to best advantage. While considerable progress in this direction has been made by the important wool-growing industry, there is yet scope for substantial improvement. Grading and classing have been carried out in this industry ever since its inception, especially on the big holdings where qualified classers are retained during the shearing season. In most cases, however, the small grower has been content, through ignorance of the art of wool-classing, or financial inability to employ a classer to grade his small clip, to allow his wool to go to the broker in a condition to their mutual disadvantage.

In addition to the disadvantage the wool suffers through lack of proper classing, there is the further disability that no amount of wool-classing efficiency on the part of the small grower can overcome, and one which, in fact, is peculiar to the small clip. Wool marketed in small quantities, no matter how well graded it may be, does not command the prices obtained for wool in larger, more evenly-balanced lots. It is here that classing and grading reform in the wool industry is necessary, and this reform may be made only by classing in the bulk.

The main object of the bulk classing system is to mass and place on the market in the best marketable state, true, even lines of wool, which belong to various small owners, instead of numbers of small parcels such as bags, fadges, and light-weight bales. It also facilitates the actual marketing, it being recognized generally that brokers can handle bulk-classed wools with more ease and economy than the same wools in irregular packages, bags, and light-weight bales. Further, it is an accepted fact that four-bale lines and over, providing the wool is even and true, sell more readily, and with more profit to the grower than two or three-bale lines.

Under the bulk classing system, the contents of the original package are graded and put into separate bins, when the quantity of each sort is weighed and balanced with the total weight received. As an example, a bale weighing 350 lb. net may be divided into, say, 220 lb. of fleeces, 100 lb. of pieces, and 30 lb. of locks. Each owner is credited with and paid the exact value of each different class of wool forwarded, even though there be several owners' represented in the one bin. When a sufficient number of bales of the same quality are packed, the wool is then offered in lines as big as possible.

The following table of figures, supplied by Messrs. Dennys, Lascelles Ltd., Geelong, illustrate the advantage of bulk over bag selling. These figures, which are the result of exhaustive tests, show a distinct gain to growers where the wool is "bulk classed."

Bag Sale.	Bulk Classed.	Gain to Growers (after allowing for bulk classing charges).
d.	*d.*	*d.*
7¼	10	2½
6	11½	4⅞
8	10¼	2⅛
7	9¼	1⅝
2	4	1⅜
7¼	9¾	1⅞
8½	9¾	1⅜
2	3	¾

Messrs. Dalgety and Co., Melbourne, also have given close consideration to the system, and supply the following examples as an indication of the benefits to be expected:—

10 Bales X Pcs. passed 20th Dec.	Bulk Classed.	Gain to Growers allowing for all charges).
4½*d.*	7⅜ Average	2¼*d.*
7 Bales AX Pcs. passed 28th Nov.		
3¾*d.*	6¾ Average	2⅜*d.*

The Australian Wool Inquiry Committee investigated the bulk wool-classing system, and found that while there is an increase in the number of small growers who cannot afford to pay a qualified classer, there are good and increasing facilities available (in the larger centres at least) for the centralized classing of small clips, and of mixed clips generally, which, were they more fully utilized, would be of greater benefit to growers and the industry in general.

The committee strongly urged growers to obtain the advantages now possessed by the larger growers, by having their wool classed in bulk by trustworthy agents at a central depot, even if this meant the sacrifice of the identity of their clip—a trifling matter compared with the gain accruing from such procedure.

In the wool-selling season, the brokers' show floors usually contain a considerable number of bales improperly prepared for the market, while most wool-brokers' catalogues contain many separate lots which could be dealt with more successfully in one or two lots, made possible by bulk classing. This would mean better preparation of the wool, better presentation for sale and a shortening of catalogues, allowing wool-buyers to devote more time to the lots offered for sale.

The British Wool Federation has expressed the view that the extension of bulk classing would be of distinct advantage to the trade. This body also stresses the need for proper supervision and the carrying out of the classing by competent hands so as to avoid any possible lack of uniformity in the grading.

It is estimated that 25 per cent. of the Australian wool clip could be so treated under the bulk-classing system, and from the national as well as the individual point of view, the adoption of this system would be of inestimable value.

Wool Classers at work.

Rabbit Destruction

Digging Out, Fumigation and Poisoning

A RECENT proclamation under the *Vermin and Noxious Weeds Act* 1928 makes it compulsory for land-holders to destroy all vermin on land occupied by them and on the adjacent half-widths of all roads adjoining their properties. This simultaneous destruction of vermin was to commence on 17th July, 1933.

Recent years have been marked by a serious increase in the number of rabbits in Victoria and New South Wales, and it is essential that vigorous steps be taken for the suppression of this pest. Various methods of eradication and destruction are available, and if one or other of these be carried out properly by all land-holders, the menace should be effectively checked.

Rabbit destruction may be carried out more effectively at some periods of the year than others, one of the most favorable being that just prior to the spring breeding season.

The principal methods of dealing with the pest in the winter time are digging out, fumigation, and strychnine poisoning. Methods advocated by Mr. J. Matthams, Superintendent of the Vermin and Noxious Weeds Branch of the Lands Department are set out below:—

Digging Out.

Winter is the most suitable time for digging out, as the earth is then in a moist and easily workable condition. Before commencing work each day it is advisable to scour the paddock with dogs to hunt any rabbits concealed in surface cover into the burrows. In commencing operations in a paddock, one should dig from the boundaries, and gradually work in towards the centre, as the usual tendency of the rabbits is to go into the paddock rather than out of it.

When digging large burrows mark all branches and offshoots with a stake so that after the main burrow has been dug out they may be located and dealt with. If they are not so marked, there is a possibility of their being lost, and portion of the burrow remaining habitable. After thoroughly digging out a burrow, it is advisable to fill it in as a precaution against injury to stock. It is also a good plan to inspect all burrows a few days after they have been dug out to see if by chance some of the offshoots of the burrow containing rabbits have been missed. Digging out, while being one of the most effective methods of dealing with the rabbit, must be done thoroughly to be effective, and to dig out a burrow while leaving an offshoot containing rabbits is merely to toy with the problem.

Fumigation.

Another practical method of rabbit extermination is fumigation. Many kinds of fumigants are in use, the better known being carbon bisulphide (known as "carbon"), and calcium cyanide. Fumigants are found particularly useful in destroying rabbits in hard or rocky land, in the banks of creeks, under shelves of rock, and other places where the ordinary digging-out methods cannot be performed except with difficulty and an amount of labour disproportionate to the value of the work done. Some land-owners rely for rabbit destruction almost solely on fumigation, which has the

advantage, especially on large holdings, of being quicker and less expensive than digging out.

The method of using the fumigator is to break down the mouth of the burrow after inserting the hose connexion, pack the earth close, and pump in the fumes, after which the hose is removed, and the hole from which it was withdrawn blocked up. All other openings to the burrow should be blocked up. When selecting an opening to commence operations, it is advisable that it be on the windward side, so that escaping fumes will not blow back on the operator.

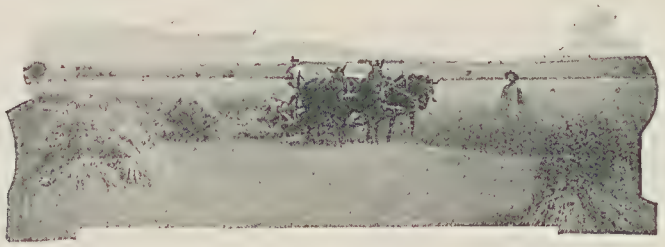
Poisoning.

Strychnine poisoning, with either apples or carrots as bait, is another method used during the winter months. Rabbits will not take apples or carrots as readily in winter as in summer, when there is an absence of juicy food, but apparently they relish the change of diet carrots and apples give, and strychnine poisoning is now regularly and successfully carried out each winter by many farmers.

When using apples, select where possible only fruit that is sweet and sound. It is advisable to add a little sugar, whether they are used either for free feeding or when mixed with poison. It is very necessary to have the unpoisoned and poisoned bait as attractive as possible. If sour apples only are procurable, 1 lb. of sugar should be sprinkled on to about each 12 lb. of bait, which, when cut up, should be cubical in shape, with each surface about ½ inch square. After mixing the sugar with the bait, lay it out on a bag for some time to drain. Then place the bait in the mixing vessel, and apply strychnine. The best plan is to place only 2 or 3 lb. of bait in the mixing tin at first, sprinkle a little strychnine on it, mix well, and then add more bait, and sprinkle more strychnine until the whole quantity required for the poisoning has been mixed. Use 1 oz. of strychnine to every 12 to 16 lb. of bait. If the strychnine is not in its powdered form, it will be necessary to powder it by rolling it with a bottle on strong brown paper, or suitable substance from which it can be deposited conveniently into a pepper canister or a small round tin with a perforated lid. The poison baits should be laid from about 18 inches to 5 feet apart, according to the state of infestation of the country.

Carrots are prepared in the same way as apples. Sugar is absolutely necessary, otherwise the strychnine will not adhere to the bait. As with apple bait, place the carrots on a bag after applying the sugar, and allow them to drain before dusting with strychnine.

Furrows in which the baits are laid should run as close to the infested spots as possible, and be situated so that the rabbits must cross them on their way to their feeding grounds. It is not advisable to draw the furrows close to the burrows when the country there is eaten out and polluted, as is often the case in the dry season of the year, for the rabbits on leaving the burrows, may travel some distance towards the feeding grounds without stopping. In the breeding season, however, if the grass is plentiful about the burrows, furrows drawn close to them often account for a number of kittens which are independent of their mother, but do not travel far from home.



Grass Tetany

By R. N. Johnstone, B.V.Sc., Senior Veterinary Officer.

GRASS tetany is a disease affecting cattle, and is characterized as a rule by sudden attacks which often terminate fatally. While the great majority of cases occur in milking cows, the disease has been observed in young cattle which have not been bred, in dry empty cows, and very rarely in bulls.

Speaking generally the disease is most prevalent during the early spring months when there is a rapid growth of fresh green grass, but cases have occurred in the autumn and, occasionally, in stall-fed cows.

Prior to the war grass tetany was very rare in Victoria or was not recognized, but during the past few years a great number of cases have been observed in different parts of the State. These have given rise to demands for investigation which, because of shortage of staff and the necessary equipment, we have not been able to satisfy. In these circumstances the best that can be done is to convey to stock-owners information gained in other parts of the world where the disease has been prevalent and where extensive investigations into its cause and nature have been carried out. As a result of investigations carried out in Holland and Great Britain by highly-trained veterinary specialists employing extensive laboratory equipment, certain facts have been discovered which give us much improved knowledge of the causes underlying the disease and methods which may be adopted in control.

Symptoms.

Two types of the disease have been recognized—acute and sub-acute. In the acute type the onset of the disease is so rapid that nothing unusual is noted before the animal is found lying down and unable to rise. The respiratory rate is increased, the muscles twitch and the animal is in a state of intense excitement, clamping the jaws and frothing at the mouth. Death usually occurs within a few hours, sometimes in a few minutes.

In the sub-acute type the first symptoms shown are involuntary twitching of the muscles, sometimes only in certain parts of the body, nervousness, the animal refuses to graze with other animals, unsteady locomotion, widespread hind limbs, and loss of appetite. As the disease progresses the muscular spasms increase in violence, the ears stand erect, abnormal contractions of the neck muscles cause a backward thrust of the head, sometimes the jaws are rigidly closed, the eyeballs roll widely. This stage is accompanied by violent excitement, the animal strikes heavily with all four feet and alternately falls down and gets up with a jerk or fails to rise; some affected animals froth at the mouth and bellow, the pupils of the eyes contract and the animal appears to be blind, and will run against walls, fences, or trees or fall into ditches. After the animal has fallen down the violent movements of the limbs continue and it dies in convulsions. Sometimes the excitement is followed by a period of coma or depression. The condition then resembles milk fever, but varies from that disease by the fact that the muscles are rigid, the mouth is closed spasmodically, the animal is excited, irritable, and has a wild look and the mucous membranes of the eye are blood-shot, whereas in milk fever the muscles are slack, the senses are dull, the animal has a dreamy look, the membranes of the eye are rather pale, and the head is carried in a different position.

In some cases of grass tetany in milking cows the milk yield decreases rapidly, in others there is a gradual and not very great reduction, and many farmers recognize this as the forerunner of an attack. There is a throbbing pulsation of the heart, which can sometimes be heard at a distance of a yard or more. There is no fever, but, because of disturbances of the circulation and breathing, the temperature may vary.

The death rate varies greatly; some apparently mild cases persist and end fatally, while others which seem much more acute recover rapidly. On recovery the appetite for the first few days remains poor and the milk flow is diminished, but very gradually the animal becomes quite normal again. Cattle which have suffered an attack should be carefully watched in subsequent years in order that a recurrence may be anticipated and preventive measures adopted.

Post-mortem Appearances.

The post-mortem appearances vary according to the severity of the attack. Following on a very acute fatal attack the flesh may be found dark red in colour, the lungs may be engorged with blood and filled with air which has burst through the air vesicles and entered the surrounding tissue. After attacks of longer duration the flesh may be pale, moist, and degenerated, and haemorrhages varying in size may be found in the tissues lining the body cavities and covering the lungs and bowels.

Cause.

The fact that this disease has shown a great increase in those districts where dairying is carried on intensively and where farming methods have improved greatly during recent years, and more particularly on those farms where heavy topdressing of pastures has become the practice during recent years and where cattle are fed large quantities of concentrates in an endeavour to increase their milk yield, has led to a consideration of the factors associated with these practices which might reasonably be assumed to cause grass tetany. Consequently investigations have been carried out to determine whether heavy topdressing produces any injurious grass or if overfeeding on protein rich pastures can be the cause of the disease. Analyses of blood taken from affected cattle have also been carried out to determine if lack of some essential mineral substance is responsible for the sickness, which in many cases so closely resembles milk fever.

The present is not a suitable occasion on which to give a detailed account of the work which has been done and the results achieved, but, briefly, distinct differences have been found in blood from normal animals and that from animals affected with grass tetany, while that from cows affected with milk fever differs from each.

In grass tetany the only mineral which is consistent in its departure from the normal is magnesium. This is invariably less than normal, and in some instances the amount present is so small that accurate analysis is extremely difficult. In grass tetany the percentages of calcium and phosphorus in the blood vary considerably, but in milk fever these minerals are invariably low, while magnesium remains normal.

When considering the cause of grass tetany we must not overlook the influence exerted on grasses by the application of heavy topdressings of artificial fertilizers such as super-phosphate. Beside the fact that this practice may upset the normal ratio between phosphorus and other minerals in the pasture and may thus give rise to irregularities in absorption of those minerals, we must not lose sight of the further fact that during a period of rapid growth the plant tissues are unable to convert all the nitrogen received into protein and the excess is stored up as nitrites, which are definitely poisonous to stock. These facts may have some relation to the more frequent occurrence of the disease on well-improved pastures where progressive farming methods are in practice.

While we recognize that these investigations have resulted in a definite advance in our knowledge of this disease, we must not lose sight of the accompanying fact that much more investigation is needed in order to determine why the disease appears on one farm while cattle on adjoining properties consisting of exactly similar soil, carrying the same type of herbage and receiving the same manurial treatment, remain healthy; and also why, in a herd of cattle, bred and reared in the same manner and kept under identical conditions, grazing in the same paddocks, fed and handled in the same way, in the same stage of lactation, with the same production and in apparently an exactly similar state of bodily health, several cows develop the disease while others remain free? Is this individual susceptibility due to any derangement of the body tissues or the secreting glands which interfere with the normal conversion or absorption of food products or their subsequent utilization or storage in the body? Is there any diagnostic method by means of which we may determine which cows are likely to become affected and thereby be in a position to adopt precautionary measures?

In the meantime, while awaiting the solution of these problems, stock-owners should adopt the methods of prevention and treatment which appear to offer the best chance of success.

Prevention and Treatment.

It has been shown that invariably there is a deficiency of magnesium in the animal's blood while the percentage of calcium and phosphorus show variations. On the assumption that this is the prime factor in this disease steps should be taken to remedy these deficiencies by supplying these minerals in the form of licks or by adding them to the food if cattle are being stall fed. Calcium phosphate can be easily administered in the form of bone flour or di-calcic phosphate in doses of one to two ounces daily. Magnesium in the form of inorganic salts is absorbed from the alimentary canal in very limited amounts,

[*Continued on page* 400.

Export of Oranges

Conditions of Guarantee

THE following conditions laid down by the Department of Commerce must be observed by shippers of oranges in order to participate in the Federal Government's guarantee to recoup the difference between out-of-pocket expenses and the sales realization. In other words, if the cost, including packing, case, wrapping paper, freight, insurance, selling charges, and other costs incidental to shipping, but excluding the value of the fruit, reaches 13s. per case, and the fruit realizes 10s. a case, the Federal Government will make up the difference of 3s. subject to these conditions:—

Picking of Fruit.

The fruit must be clipped from the trees by means of a blunt-nosed clipper. No protruding stems must be left on the fruit, and where necessary a second cutting in order to remove superfluous wood must be made. The fruit must be placed gently, *not dropped,* in the picking box.

Handling of Fruit.

Throughout the whole of the operations from the picking of the fruit to the wrapping and packing, *gloves must be used.* Mis-shapen or excessively corrugated fruit shall not be shipped.

Pre-Cooling.

All fruit shipped after 1st September, 1933, must be pre-cooled to a temperature not lower than 38° F. nor higher than 42° F. Wherever possible fruit shipped prior to that date must also be pre-cooled.

Grading.

Oranges shall comply with the following provisions:—

(*a*) The outer layers or shown surfaces of the oranges shall be a true indication of the contents of each case;

(*b*) Each case shall contain one variety of orange only, and the oranges shall be wrapped in paper of a quality approved by the Secretary, Department of Commerce.

(*c*) The oranges in any case shall not vary in size by more than one-quarter of an inch, and no orange shall measure less than two and one-quarter inches in diameter. For the purposes of this paragraph—

"Two and one-quarter inches" shall include fruit of a size two and one-quarter inches or greater diameter, but less than two and a half inches;

"Two and a half inches" shall include fruit of a size two and a half inches or greater diameter but less than two and three-quarter inches;

"Two and three-quarter inches" shall include fruit of a size two and three-quarter inches or greater diameter but less than three inches;

"Large" shall include fruit of a size three inches or over in diameter.

(*d*) The oranges shall not be dry. They shall be mature, of normal shape and appearance common to the variety, sound and of reasonably even colour, and shall be packed in either of two grades, namely, "Special" or "Standard."

"Dry," in relation to oranges means that the proportion of juice extractable is less than 35 per cent. by weight of the whole orange.

"Mature" in relation to oranges means that the fruit shall be in such condition that

the quantity of N/10 soda solution required to neutralize the acidity content of 10 cubic centimeters of juice drawn from the mixed juices of not less than five oranges taken at random from any case or cases bearing a similar mark shall not be more than—

(i) 30 cubic centimetres in the case of oranges intended for shipment to European destinations; and

(ii) 26 cubic centimetres in the case of oranges intended for shipment to any other destination.

(*e*) Oranges described as "*Special*" shall consist of oranges complying with the requirements of paragraph (*d*) of this regulation. Markings on the skin, other than those caused by disease, are permissible on any individual fruit, provided that such markings do not exceed 2½ per cent. of the total surface area of such individual fruit;

(*f*) Oranges described as "*Standard*" shall consist of oranges complying with the requirements of paragraph (*d*) of this regulation, but disfigurements such as caused by scars, scratches of the skin, excessive navel segments, cavities, punctures, and blemishes due to any fungus or insect pest may be allowed to the extent of 10 per cent. of the total surface area;

(*g*) In order to ascertain the proportion of juice extractable from an orange, the halves of a freshly-divided orange shall be rotated upon a conical glass lemon-squeezer under hand pressure only. The resultant juice shall be strained through a strainer of not less than 30 meshes to the lineal inch; and

(*h*) Oranges shall not be exported unless they have been sweated prior to packing for a period of at least seven days.

Packing.

The oranges shall be packed in clean, new cases constructed of well-seasoned softwood or hardwood that has been smoothly sawn or dressed in an approved manner. The dimensions of the cases shall be as under—

Case of Oranges wrapped and packed for Export.

Description of Case or Tray.	Inside Measurements in Inches (clear of divisions).		
	Length.	Depth.	Width.
Orange Case	24	11½	11½
Australian Bushel ..	18	14¼	8⅝
Standard Bushel ..	18	10½	11½

The timber used in the construction of the cases shall be not less than the following dimensions:—

"Orange" Case.

Two ends, one centre—11-16 in. thick, 11½ in. wide, 11½ in. deep.

Sides and bottoms (six pieces)—¼ in. thick, 5¼ in. wide, 26 1-16 in. long.

Unitized lid (four pieces)—5-32 in. thick, 2½ in. wide, 26 5-16 in. long.

Cleats (two pieces)—¼ in. thick, 1¼ in. wide, 11½ in. long.

"Australian Bushel" Case.

Two ends—¾ in. thick, 8⅝ in. wide, 14¼ in. long.

Sides (six pieces)—⅜ in. thick, 4⅝ in. wide, 19½ in. long.

Tops and bottoms (four pieces)—¼ in. thick, 4¼ in. wide, 19½ in. long.

"Standard Bushel" Case.

Two ends—¾ in. thick, 11½ in. wide, 10½ in. deep.

Sides—⅜ in. thick, 10½ in. wide, 19½ in. long.

(If sides are made of two pieces for each side, the width of each piece shall be not less than 5¼ inches.)

Four cleats (one each end, top and bottom)—⅜ in. thick, ¾ in. wide, 11½ in. long.

The cases shall be wired or strapped at both ends and strapped in the centre.

Oranges intended for export to any port in Europe or Canada or to any eastern port shall be packed only in the type of case described as "Orange" above. Provided that in special circumstances oranges intended for exportation to any eastern port may, with the approval of the Secretary, Department of Commerce, be packed in either the Australian bushel or Standard bushel case referred to above.

Crates or other approved loading gear must be used for the loading of the fruit at the ship's side.

Fruit intended for shipment to the United Kingdom must not be treated by the borax treatment as fruit so treated is prohibited importation into the United Kingdom.

GUARANTEE.

The Government guarantee shall apply only to the following fruit:—

(*a*) Oranges exported from Australia during 1933 to all destinations except New Zealand; and

(*b*) Oranges of "Special" and "Standard" grades only as defined herein.

All adjustments shall be effected through the shipper of the fruit. The shipper is defined as the grower, forwarding agent, or other person who actually ships the fruit, whether it be on his own behalf or on behalf of a corporation of growers or an individual grower. Such shipper shall be required to lodge with the State Supervising Officer for Fruit, Department of Agriculture, in the respective consigning States, a detailed statement of each consignment showing the name and address of the co-operative organization or the individual grower, and such statement shall be covered by a statutory declaration by either the shipper or the packer that the prescribed conditions have been complied with.

MARKING OF CASES.

The following particulars are to appear in prominent and legible characters on the end or ends of the cases:—

1. A true description of the fruit (e.g., "Washington Navel Oranges" or "Valencia Oranges" as the case may be).
2. The word "Australia."
3. The name or registered brand of the grower or the exporter.
4. The number of oranges contained in the case.
5. The grade of the fruit, e.g., "Special" or "Standard" as the case may be.

Grass Tetany

(*Continued from page* 397).

but the addition of Epsom salts to the feed or its administration by the mouth at intervals might supply the deficiency.

Claims have been made for treacle as a preventive in this disease. On analysis by one investigator the discovery was made that treacle contains a high percentage of magnesium, and possibly in a form more readily available for absorption by the animal. A rough calculation shows that there is more than enough magnesium in ten ounces of treacle to replace the magnesium deficiency in a normal sized cow, and therefore I would suggest that the animals be given free access to licks containing salt, bone flour, and Epsom salts and a percentage of treacle.

If symptoms are noticed at the early stages, the animals should be fed grass hay or cereal hay and kept away from pasture. A drench containing one pound of Epsom salts and one pound of treacle should be administered. In the more advanced cases inflation of the udder frequently proves beneficial. At this stage the administration of medicine by the mouth is not advisable unless a stomach tube is used. If a veterinary practitioner is available, intravenous injections of various salts of calcium and magnesium may be administered. A fair percentage of recoveries occur, but prognosis is difficult. Some apparently mild cases die despite treatment, while others which appear hopeless make a spectacular recovery.

Household Insects and their Control

2.—Common Insect Pests

By C. French, Government Biologist, and R. T. M. Pescott, M.Agr.Sc., Entomologist.

The first article of this series, dealing with the use of insecticides and fumigants, was published in the July issue of this Journal.

THE insects which attack human beings and their foodstuffs comprise a large section, which may be divided into three main groups:—

(*a*) Flies and mosquitoes: e.g., house-flies, blowflies, and mosquitoes.

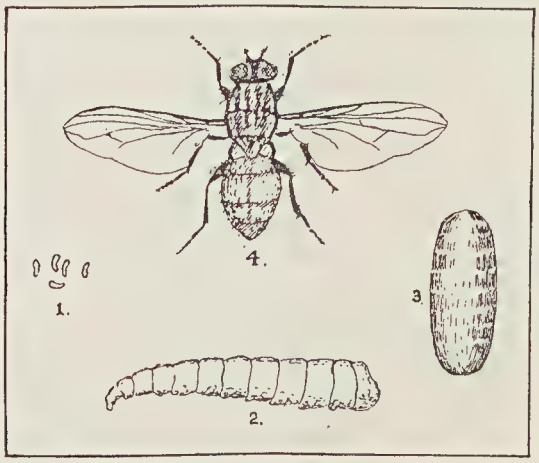
(*b*) Body parasites: e.g., fleas, lice, and bed-bugs.

(*c*) Insects affecting foodstuffs: e.g., cockroaches and ants.

The House-fly (Musca domestica L.).

The term "house-fly" is popularly used at the present time for all the different types of flies, apart from the blowfly, found in the dwelling. In its strict sense, it is made to apply only to the insect known as *Musca domestica* L., which is now probably the most widely distributed insect in the world. It is, without doubt, responsible for the spread of more disease and suffering than any other insect, and yet, because of its very commonness, is popularly regarded as more or less harmless, though irritating and annoying. From a public health point of view, the common house-fly is frequently referred to as the typhoid or filth fly, with the object of impressing on the public the fact that this insect is a very real menace to health. It serves as a mechanical agent in the spread of all kinds of infectious diseases, and is responsible for the dissemination of many intestinal diseases such as typhoid fever, cholera, dysentery, and summer diarrhoea in infants, while there is little doubt that tuberculosis, smallpox, parasitic worms, and many other diseases are spread by flies.

The manner in which these diseases are carried is quite different from that in which mosquitoes and other skin-piercing insects spread infection. The house-fly has no organ capable of piercing the human skin, and therefore cannot transfer organisms directly from one person to another. Its food for the most part consists of two distinct types; (*a*) human food; and (*b*) excremental products, purulent discharges, and moist surfaces. Should these latter contain pathogenic organisms, they will be conveyed, entangled in the hairs of the legs and body of the fly, to foodstuffs, and thus to the digestive tract of man, or, in other cases, directly to moist places, such as the human eyes and nose. The habit of the fly in living on human filth and excrement, and finding its way indoors to deposit vomit spots and foecal droppings reeking with bacteria, on foodstuffs and utensils, should be sufficient to indicate the danger of allowing the house-fly to multiply unchecked.



The House Fly.

1. Eggs. 2. Larva. 3. Pupa. 4. Adult.

Life History.

The house-fly passes through four stages in its life cycle, viz., the egg, the larva or maggot, the pupa, and finally the winged adult. The

female fly deposits its small, elongated, pearly-white eggs in batches of 100 to 150, in horse manure for preference, though it will breed freely in human excreta, fowl manure, rotting garbage, or almost any accumulation of rotting and fermenting vegetable matter. The eggs are about one-twentieth of an inch in length, and are laid in several batches (as many as 600 eggs being laid by one fly in a season), in crevices in the manure, &c., and are therefore rarely seen.

In the summer time, these eggs hatch within 24 hours, to small, transparent, legless maggots which feed voraciously on the material surrounding them, and may readily be seen as writhing masses close to the surface of the material in which they are developing. They grow rapidly, and under favorable weather conditions may become full grown in from three to four days, though the larval period may be greatly prolonged owing to adverse conditions, such as cold weather, unsuitable food, &c. On reaching maturity, the larvae are ready to pupate, and for this purpose migrate to a suitable place such as along the edges of the manure heaps, in the surrounding soil, or in the ashes and soil with which city garbage heaps are frequently covered. If the ground is soft, the larvae may bury themselves as deeply as 29 inches before pupating to a hard, smooth, dark-brown puparium, about ¼-inch in length.

The time occupied in the pupal stage depends on weather conditions, being roughly four or five days in summer, to as many months in the winter. The fully developed fly then emerges from the puparium, and in a few days the female is capable of laying eggs. In warm weather, the period elapsing from the time the egg is laid, until the emergence of the winged fly, may be less than two weeks.

A question often asked is, "Where do the flies go in the winter time?" Some appear to live throughout the winter months in the adult stage, particularly in sheltered spots indoors, but the huge majority die with the cold weather, or are attacked by the fungous disease *Empusa muscae,* which attacks them in the autumn. Flies may often be seen on warm autumn days sunning themselves on a sheltered wall, but they are very sluggish, and fall an easy prey to their enemies. When the adults die, flies in the larval and the pupal stages (their development retarded by the cold weather) await the warm days of the following spring to complete their metamorphosis, and a very short period of warmth is sufficient to bring forth a fresh generation. With such rapidity do they appear, that it almost seems that the flies have simply been in hiding ready to come out with the first warm days. It is very probable, however, that a certain amount of breeding takes place in sheltered spots throughout the year.

Methods of Eradication.

The methods for the eradication of the common house-fly may be discussed under two sections—

(*a*) Preventive measures.
(*b*) Remedial measures.

(*a*) *Preventive Measures.*—While preventive measures are always acknowledged as being far in advance of remedial methods, it is often assumed that they are of little value, unless adopted along the lines of a community effort. This, however, is not the case with the house-fly. Although flies may travel long distances (up to 10 miles or more), the majority will always be found where foodstuffs and breeding places are readily available; therefore, it is of the greatest benefit to each individual to keep his premises free from all refuse that may attract flies. All household garbage should be enclosed in fly-proof containers, kept in a clean, odourless condition, and emptied frequently. Fowl runs should be kept clean, with no accumulations of droppings. Manure when obtained for garden purposes should be used at once, and not allowed to become a breeding place for flies. Frequently the attention of the Government Entomologist has been directed to fly plagues, which have emanated from heaps of exposed garden manure.

Stables, particularly those situated in city areas, should be well constructed, the floors being preferably of concrete laid in such a manner as to allow of good drainage, and thorough cleansing. Where it is not possible to remove the manure from the premises daily, it should be temporarily stored in fly-proof receptacles, which should be constructed in the form of large concrete bins with raisable lids, so that the manure may be readily thrown in or removed. In city areas, during the summer months, collections of manure should be removed and disposed of at least twice a week. In rural districts, where practicable, the manure should be removed daily, and spread thinly in fields where the drying effects of the sun and the wind will prevent the breeding of flies.

An alternative method is to take advantage of the heat produced by fermentation when manure is placed in tightly packed piles, which should be constructed on hard ground or concrete, to prevent the larvae having access to the soil in which to pupate. The sides of the piles should be clean-cut and almost vertical, but slightly sloping toward the centre. As fresh manure is added to the pile, it should be tightly packed with a shovel. The heat produced by fermentation is effective in destroying all house-fly eggs, larvae and pupae, except possibly those close to the surface of the top layer. The application with a watering can of a solution of borax, prepared by dissolving 1 lb. of borax in 6 gallons of water, will effectively destroy any fly stages present in the top layers. Six gallons of the solution is sufficient to treat 30 square feet of surface area. Chloride of lime may also be used on manure heaps, to allay offensive odours, and thus act as a deterrent to flies.

Another method to prevent flies breeding, recommended by the United States authorities, is to use a maggot trap consisting of a shallow concrete basin, sloping slightly, and connected with a cistern by a drain fitted with a stopper. Over this basin a wooden platform is erected, constructed of strips of wood placed about 1½ inches apart nailed on a frame 1 foot high. On this platform the manure is piled. Water is kept in the basin and the maggots migrating in search of soil in which to pupate, fall into the water and are drowned. The water may be drained into the cistern by removing the stopper at intervals. Manure should not be allowed to collect in the basin. The trap is most effective when the manure heap is kept thoroughly moistened, and it is advisable to apply a small quantity of water each morning, after the stable cleanings have been added to the pile. A strong wire mesh may be used in place of the wood for the bottom of the pile.

(*b*) *Remedial Measures.* — Once the flies appear, every effort should be made to keep them out of the house. This is done by the careful screening of all doors and windows with fly wire. A useful precaution, often neglected, is to cover the ventilators and chimney tops with fly wire, as flies, especially blowflies, will frequently enter at these places. As an additional precaution, all food, especially milk, should be kept covered. In the hot weather, much can be done by keeping the house darkened during the day time by the judicious use of blinds. This serves the double purpose of making the rooms cool and rendering them less attractive to flies. While this may not always be practicable in the kitchen, it is well worth while for the remainder of the house.

When the flies are in the house, there are several means by which they may be eradicated. These may be divided into the following methods, viz., flypapers, fly poisons, and contact insecticides. Flypapers are rather objectionable in that they are unsightly and rather messy, but they have the advantage of working continuously, and needing little attention, being most useful in the kitchen, in the pantry, &c. They are usually bought ready-made, but may be easily and cheaply prepared in the home. A pound of resin dissolved in a large cupful of castor oil is heated and stirred until a clear solution is obtained, when it is spread thinly on stout paper, or on spiral wire, to be placed where required.

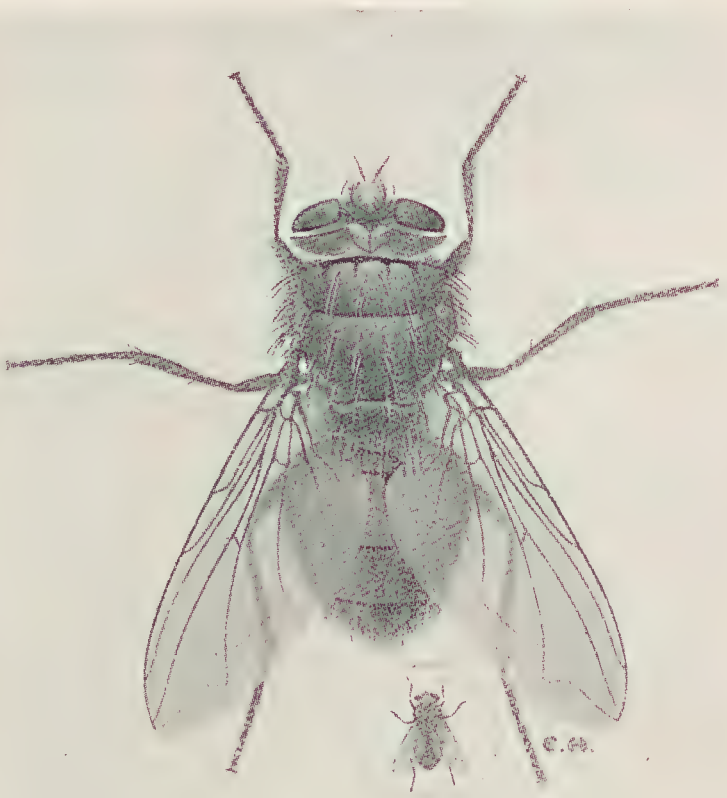
Various poisons have been used for killing flies, the commercial preparations being usually in the form of blotting paper, steeped in a chemical, which is then placed in a saucer and moistened. When the flies suck up the moisture, they are poisoned. A good poison may be made by moistening blotting paper in a plate of sweetened milk, to which has been added three teaspoons of formalin to a pint. The formalin and milk will keep for a long time in a stoppered bottle, and a little can be used as required.

The contact insecticides are all commercial preparations, taking the form of either a dust or a liquid spray. The dusts are generally pyrethrum compounds and the liquids extracts of pyrethrum, prepared as outlined in an earlier article. Almost all of these are quite efficient when used according to instructions. The powder insecticides are used most effectively sprinkled around the window frames in darkened rooms. The flies being attracted to the light become covered with the insecticidal dust, and are destroyed. The liquid is sprayed around the room, and, as well as killing the flies with which it comes in contact, makes the rooms unattractive to others.

Blowflies.

In general, blowflies are rather large in size, of a metallic blue, green or brown colour, are noisy, and deposit their eggs or living young in a variety of organic matter, such as fresh and decaying meat, garbage and human excreta. They also lay eggs in wounds and sores in living animals and man, their larvae developing therein. This condition is known as

"myiasis," which is a general term used to include the diseased conditions arising when the larvae of flies generally attack the organs and tissues of living animals and man. The larvae of blowflies which normally occur in dead animal matter on occasion have been found developing in neglected open wounds and sores, and in the nasal pasages of persons suffering from catarrh. Internal "myiasis" is sometimes caused by the maggots of certain flies invading the intestinal tracts of man. In this connexion, many species have been listed by various authors, including the larvae of the common house-fly, the cheese-fly (cheese skippers), the syrphid fly (rat-tailed maggot), and others. "Myiasis" usually occurs through carelessness or lack of cleanliness, and for prevention, open wounds and sores should be protected by antiseptic dressings. Thoroughly wash vegetables to be eaten raw, as it is possible for fly maggots to gain entrance to the intestinal tract on such food. Do not eat cheese or other food infested with living maggots. In cases of "myiasis," promptly consult a physician for treatment.



A Blowfly.

[*After Gibson and Twinn.*

Owing to their habit of frequenting faeces, diseased and decaying meat, wounds and sores, blowflies may transmit disease. They frequently enter buildings in search of food and shelter during the spring and summer months, and deposit their eggs on exposed meat. There is a number of species of these flies found in Victoria, the most common being the Green Bottle (*Lucilia sericata* Meig.), the Australian Golden-haired Blowfly (*Anastellorhina stygia* Fabr.), and the Australian Blue-striped Blowfly (*Anastellorhina augur* Fabr.).

Control.

All carcasses and offal should be disposed of by burial or incineration. Do not allow the accumulation of decaying organic matter in such places as municipal dumps, but dispose of it by burning. Protect open wounds and sores from flies. Do not expose meat where flies may deposit their eggs or young on it. Use screens on doors and windows. Flies that have gained entrance to dwellings may be destroyed with the pyrethrum-kerosene spray previously described (*Journal of Agriculture*, July, 1933).

Mosquitoes.

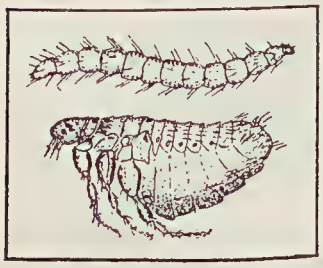
There is quite a number of species of mosquitoes in Victoria, many of which feed on human blood. Although the majority of them, particularly those of the genus *Aedes*, are most troublesome in field and woodland, in certain seasons they often cause considerable annoyance indoors as well. This is particularly so in the case of summer cottages and unscreened dwellings situated in localities where mosquitoes are seasonably abundant. Their attacks

are most noticeable at dusk, and in warm, dull, humid weather. In autumn and winter, occasionally, hibernating females of the genera *Culex* and *Anopheles*, which pass the winter as winged adults in protected situations, cause local outbreaks. The more common species (*Aedes*) is to be seen only during the warm months of the year, as it overwinters in the egg stage out-of-doors.

Control.

All mosquitoes develop in more or less stagnant collections of water, and the most satisfactory way of controlling them is by eliminating the breeding places by filling or draining, or by treating the surface of infested waters with petroleum oil. One fluid ounce of an oil of good spreading quality is sufficient to treat 15 square feet of water surface. Householders may assist in such work, and alleviate to some extent local conditions, by screening water containers and eliminating or oiling small bodies of water in which mosquitoes are known to be breeding. Doors and windows of dwellings should be properly screened, preferably with screens of not less than 16 meshes to the inch. Mosquitoes, which have gained access to buildings, should be destroyed by spraying with the pyrethrum-kerosene spray previously described.

Fleas.



Flea and its Larva.

Fleas are frequently troublesome in houses, particularly during the late summer and early autumn. They are small, hard-bodied, active insects, wingless, but possessing powerful legs well fitted for jumping. Their mouth-parts form a lance-like piercing organ with which they penetrate the skin of their victim and suck blood. Their bodies are remarkable in that they are flattened laterally, and with the backwardly projecting spines with which they are equipped, they are assisted to make rapid movement along the hairs of their host. The species most commonly found are the Human Flea (*Pulex irritans* L.), the Cat Flea (*Ctenocephalus felis* Curt.), and the Dog Flea (*Ctenocephalus canis* Bouche). The Human Flea is the commonest of the three species, while the Cat and Dog Fleas will readily attack human-beings under certain circumstances.

The eggs of fleas, which are small white oval bodies, are deposited loosely among the hairs of cats and dogs and other animals, or in their sleeping places. They hatch in a few days into tiny cylindrical, legless grubs, which feed on organic matter in floor cracks and under carpets, &c. On reaching maturity, the larvae spin silk cocoons in which they transform to the resting or pupal stage, emerging later as adult insects. The length of the life-cycle varies from two weeks to several months or more, depending on temperature and humidity conditions.

Control.

When houses are infested, the rooms should be thoroughly scrubbed out with hot water, mixed with phenyle and soap. Sheds, dog kennels, and other infested outbuildings, should be cleaned out, and all the sweepings burnt, and they should then be thoroughly sprayed with benzole emulsion, at the rate of 1 lb. to 5 gallons of water.

Occasionally during the summer months, fleas breed in large numbers in the sandy soil in some of the Melbourne suburbs; at times becoming so numerous that people are unable to go into their gardens without "picking-up" many of these pests. Animals should be provided with rugs and sacks to lie on, and these should be frequently brushed and shaken. The animals should be regularly washed with soap, phenyle, and water, a 2 per cent. solution of phenyle for cats, and a 3 per cent. solution for dogs being the most suitable. Dusting the animals with pyrethrum is also effective.

Lice.

Lice thrive on people living in an unclean and crowded environment, but even the cleanest of persons may become temporarily infected by contact, or association with their less clean fellows. There are three species of lice which feed on human blood, namely, the Head Louse (*Pediculus capitis* de G.), the Body Louse (*Pediculus corporis* de G.), and the Crab Louse (*Phthiris pubis* Leach).

Head and body lice are small wingless insects, elongate-oval in shape, and one-sixth of an inch or less in length, varying from white to brown in colour. Methods directed with a view to their control are of importance not only from the stand-point of cleanliness and comfort, but also because in many parts

The Head Louse (enlarged and natural size).

of the world lice play a vital role in the dissemination of diseases such as typhus fever, relapsing fever, and trench fever. Head and body lice are almost indistinguishable in appearance, but the head louse is usually smaller, darker, and more active than the body louse. The head louse lays its tiny oval eggs or nits on the hairs of the head, and the body louse on the clothing and hairs of the body.

The crab louse is smaller than either the head or body louse, and in general appearance, resembles a tiny crab. Its body measures about one-fiftieth of an inch in length, and its legs are large in comparison to the size of the body. and clumsy in appearance, particularly the two hind pairs, which are armed with strong claws well adapted for clinging to hairs. This species is not known to carry disease, but sets up irritation and fever by its feeding activities. It lives on the hairy portions of the body, particularly about the pubic regions and armpits, and its presence may be detected by the appearance of small irregular blue spots on the affected portions of the body, and by the irritation set up. The crab louse adheres loosely to the skin of its host where it embeds its mouth parts, often remaining feeding in one place for several days.

Control.

To control body lice and crab lice, the infected person should completely disrobe, and place the clothing in a receptacle for subsequent treatment. The body, particularly the hairy parts, should be treated thoroughly with a 2 per cent. lysol solution, pure kerosene, or kerosene emulsion, prepared by thoroughly mixing together equal parts of kerosene and soft soap, or olive oil. The latter is a non-irritant and, therefore, is preferable. A mixture, known as naphthalene ointment, composed of four parts of naphthalene and one part of soft soap, is also effective. In the case of crab lice, mercurial ointment is frequently recommended, but its use is deprecated owing to its poisonous properties. Treatment with any of the above materials should be followed by the liberal use of soap in a hot bath. Head lice and their eggs may be destroyed by treating the hair with the above-mentioned kerosene emulsion, enclosing the head in a towel for an hour, and following this by a thorough shampoo. This treatment, repeated in a week's time, will destroy any lice that may have survived the first treatment. Where there is any likelihood of infestation, children's hair should be kept short, and regularly combed with a fine-tooth comb. To rub the hair with vinegar before using the comb is helpful in loosening nits which may be present. The head covering of infested persons should also be treated.

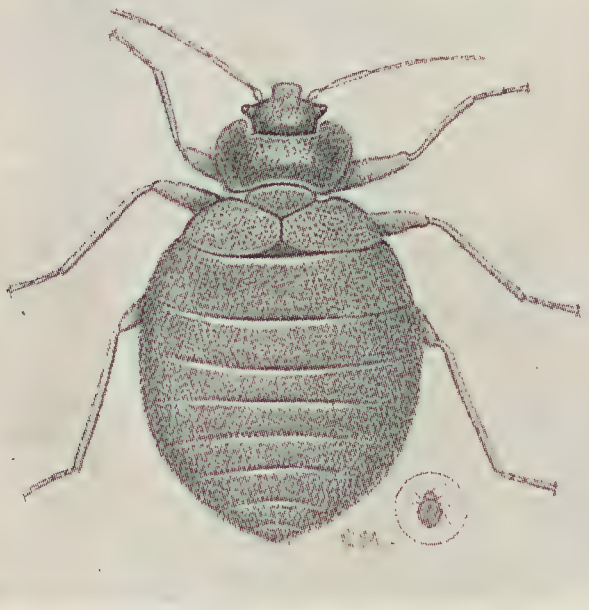
Lice and their eggs on clothing may be destroyed by placing the clothing loosely in an oven, and subjecting it to a temperature of 130 deg. F. or higher, if this can be done without damage to the clothing, for a period of at least one half-hour. Under-garments should be boiled, when there is no danger from shrinking, but woollens should be soaked in a 2 per cent. lysol solution, followed by a thorough washing in soapy water. The use of a hot iron on outer clothing, particularly along the seams, is also effective.

The Common Bed-bug.

The bed-bug (*Cimex lectularius* L.), is found most commonly in old buildings, hotels, and boarding-houses, but may occur in dwellings of any kind. Its presence is most nauseating owing to its blood-sucking habits and obnoxious odour.

Bed-bugs are oval, flattened, reddish-brown, wingless insects, measuring about one-quarter of an inch in length when fully grown. They possess piercing and sucking mouth-parts, and are nocturnal in habit, hiding during the day time in cracks and crevices in walls, woodwork, and furniture, behind pictures, and under loose wallpaper. Both male and female bugs feed on the blood of mammals, particularly that of human beings, and are capable of existing for long periods without food. They will migrate short distances in search of food and, consequently, one infested apartment is a continual menace to others in close proximity.

The bed-bug lays its small, white, elongated eggs in the cracks and crevices used as hiding places. Eggs are laid also, in badly infested



The Bed-bug.

[*After Gibson and Twinn.*

houses, in blankets, mattresses, the woodwork and springs of a bed, and hatch in from seven to fourteen days, the period of incubation depending on temperature conditions. The young nymphal stages on hatching from the eggs resemble the mature bugs, but are smaller and paler in colour until after feeding. They moult or shed their skins five times before reaching maturity, and at least one meal of blood is necessary between each moult. The life cycle of the bed-bug, from egg to adult, occupies from six weeks to a year, its period depending almost entirely on the temperature and food conditions.

Control.

The control of the bed-bug is most satisfactorily accomplished by fumigating with hydrocyanic acid gas. Fumigation with sulphur dioxide by burning sulphur has been frequently recommended in other parts of the world, but recent tests have shown that this method is unsatisfactory. Liberally spray with petrol, kerosene, or the kerosene-pyrethrum spray mixture previously described, all cracks and crevices in walls, woodwork, furniture, &c., wherever the bugs may hide. Remove old, torn, and loose wallpaper, and after thoroughly washing down the walls, re-paper them. Wherever possible, fill up cracks in walls, floors and cupboards with putty, and finish with a coat of paint or varnish.

The two main insects which attack materials used for food, and either render them unfit for consumption by contamination, or adversely affect them in quality and quantity, are cockroaches and ants. The housefly which also affects foodstuffs, has been previously discussed.

Cockroaches.

Cockroaches are frequently abundant in apartment-houses, hotels, stores, and other buildings, where there are warm moist conditions, and an abundance of food. These insects have flattened horny bodies, and large spiny legs, which enable them to move quickly, and take refuge in cracks and crevices in the building. In such places, they remain hidden during the day, emerging at night to seek their food. Cockroaches are omnivorous in their habits, and are particularly fond of foodstuffs favoured by man. On this account, they are usually to be found about kitchens and pantries, and other locations where food is abundant.

The eggs of cockroaches are developed within a small horny capsule or case, which is deposited by the female, usually in a warm moist place. The young or nymphs which hatch from these eggs are similar in appearance to the adult cockroaches, but are smaller and lack wings. Cockroach infestations often may be detected by the presence of cast skins, and empty egg capsules on shelves and in cupboards, even when the living cockroaches have escaped attention. Cockroaches also emit a peculiar odour, which is sometimes imparted to the food over which they have walked, and even to crockery and other utensils.

There are four species of cockroaches commonly found in buildings. The German cockroach (*Blatella germanica* L.) is a small species, measuring about five-eighths of an inch long when mature. It is light-brown in colour, and bears two distinct dark-brown longitudinal stripes on the thorax. The American cockroach (*Periplaneta americana* L.), is a larger species which is less commonly found. It measures about 1½ inches long, is light-brown in colour, and possesses strong, well-developed wings in both sexes. The Oriental cockroach (*Blatta orientalis* L.), is probably

The German Cockroach.

the commonest species found in Victoria, particularly in those buildings where imported goods are handled. This insect is dark-brown to black in colour, measuring about 1 inch in length when mature. The female is wingless, while the male has abbreviated wings. The Australian cockroach (*Periplaneta australasiae* Fab.), is also sometimes found, and is distinguishable by the presence of a narrow yellow stripe on the sides of the upper wings.

CONTROL.

Cockroaches may be readily controlled by means of sodium fluoride. This material should be lightly dusted in places frequented by them, such as about sinks, cupboards, hot water pipes, &c. The sodium fluoride adheres to their legs and antennae, and in cleaning themselves they are poisoned by the powder. Sodium fluoride retains its effectiveness, and may be left undisturbed as long as convenient, or until the cockroaches have completely disappeared. As this material is somewhat poisonous, reasonable precautions should be taken to prevent children or domestic pets from gaining access to it.

Another material which forms the basis of many proprietary cockroach powders is pyrethrum. Pyrethrum powder is, however, less effective than sodium fluoride, costs more, loses its effectiveness quickly on exposure to air, and has to be used in larger quantities. Fumigation with hydrocyanic acid gas is effective against all stages of the cockroach, except the egg.

Ants.

There is a number of species of ants which are troublesome in the house, the most numerous being the little black ant, the small red ant, and the sugar ant.

Ants are social in their habits, usually living together in colonies. The majority of the ants in a colony, and the ones most commonly seen, are wingless, undeveloped female workers, which are incapable of reproducing their kind. Each colony also possesses one or more true females or "queens," which are responsible for the generation of new individuals. The white helpless larvae and pupae, which develop from eggs laid by the "queen," are cared for by the workers, which may be seen transporting them to a place of safety, when the nest is threatened with danger. Ants which enter dwellings, will feed on many kinds of foodstuffs, but are particularly fond of sweet and fatty substances.

The House Ant.

CONTROL.

The most satisfactory material yet discovered for the destruction of ants is sodium fluoride. This powder should be scattered lightly in places frequented by the ants, and left until the insects have disappeared.

The nest of the Sugar Ant (*Campanotus nigriceps* Sm.) should be easily located. The entrance should be enlarged with a sharp stick,

about half a cupful of carbon bisulphide poured down, and plugged with clay or heavy moist soil. The fumes will penetrate the galleries of the nest, and kill the ants in all stages.

As an alternative to the above, baits may be used, and the following formula has been proved very satisfactory:—

Arsenite of soda ..	1 dram.
Honey or treacle ..	1 lb.
Water	1 quart.

Mix these together, and place a little of the mixture in shallow vessels where the ants are numerous. In a few days it will be found that the ants have completely disappeared.

Safes, &c., which are isolated from the walls may be kept free from ants by tying a piece of rabbit skin or other fur round the legs; the ants do not seem to be able to cross this. Borax liberally sprinkled about is also a good deterrent.

Farm Produce Agents

The following is a further List of Licences issued (to 20th July, 1933) for the current year.

Name of Licensee.	Court where Issued.	Name of Licensee.	Court where Issued.
Anderson, L. D., and R. S. ..	Prahran	Gibson, William Johnston	Wedderburn
Bayfield, Edwin Henry	Melbourne	Gray and Edmonds	Melbourne
Beatty, William	Sale	Gray, Montrose Lionel	Box Hill
Berry, James	Warburton	Holden, Richard Herbert	Lilydale
Boldt, Richard Henry	Lilydale	Kilpatrick, McLellan and Co. ..	Numurkah
Britt, John Leslie	Box Hill	Must, Frank	Melbourne
Bucknell, Charles William	Melbourne	Nicholas, E.	,,
Campbell and Co.	Numurkah	Norton, Ernest A.	Shepparton
Cheers, Stanley Alfred James ..	North Melbourne	Peachey, R. A. Pty. Ltd.	St. Kilda
Chinn, F. A. and Co.	Melbourne	Quong Hie Shing	Melbourne
Clarkson, E. and Sons	Ferntree Gully	Rice Bros.	,,
Cope, H. E.	Box Hill	Rice, Oliver James	Ferntree Gully
Davis, Lancaster and Co.	Melbourne	Rogers, George Vining	Melbourne
Dedrick Grain and Storage Co. Pty. Ltd.	Caulfield	Smith, William	North Melbourne
		Thompson, Samuel Walter	Lilydale
Demattina, Francisco	St. Kilda	Vear, F. W. Pty. Ltd.	Melbourne
Gaudian, Percival George	Lilydale	Wong Hee, C. and Co.	,,
Gibbons, Reginald Leslie Alfred ..	Shepparton	Wood, C. H. and Co.	,,

Book Review

PROFITABLE FRUIT CULTURE. (Shell Co. of Australia Ltd.)

This compact and informative volume should be useful to orchardists. It could not reasonably be expected that such a comprehensive subject would be exhaustively dealt with in a volume of its size, but in the limited compass of its 228 pages every important phase of fruit culture has been dealt with. Beginning with the choice of orchard site, fencing, and planting, there are also chapters on pruning, on budding and grafting, insect pests and fungi diseases, insect-destroying birds, spraying, and interpollination, and, in addition, a useful spray schedule for use in Victoria, Tasmania, New South Wales, and South Australia. Well illustrated in colour and half-tone, and bound in cloth, it makes an attractive volume. Fruit-growers may obtain copies of this book free on application to the Shell Co. Ltd., Melbourne.

Orchard and Garden Notes

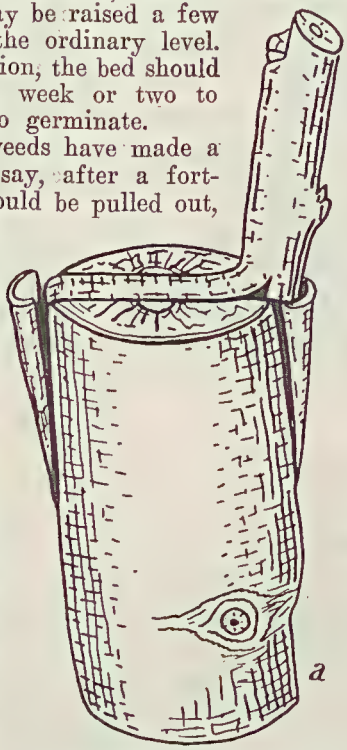
By Edward E. Pescott, F.L.S.

Oleanders.

The Flower Garden.

PREPARATION must be made now for sowing seed of summer flowering annuals. A sunny spot should be selected, and the ground well worked over. The soil should be light, sand being worked into it if necessary. No manure should be added. The bed should be well drained, and to assist in the drainage it may be raised a few inches above the ordinary level. After preparation, the bed should remain for a week or two to allow weeds to germinate.

When the weeds have made a good growth, say, after a fortnight, they should be pulled out, the soil stirred lightly, and the seeds sown into the loose surface. After sowing the seed, some well-crumbled very old manure, or leaf mould, should be sprinkled lightly over the bed to provide a cool and moist surface. Early seed sowing is favoured, since it enables a longer period of blooming, and in addition, the seedlings transplant more readily before the weather becomes hot.



A Strap Graft—scion inserted ready for tying.

Shrubs and palms may now be transplanted from pots into the garden. While doing this it is suggested that a handful of bonedust be worked into the soil, well below the roots. For hot and dry districts the Oleander is outstanding as a flowering shrub, giving its flowers in all of the sunny months. Rockery plants should be thinned out and replanted, giving the new growths the preference in planting.

The Orchard.

Fruit trees may be changed readily from one variety to another by reworking. There are several methods all of which have given considerable satisfaction in recent years. First, the tree may be entirely cleaned of all its laterals, trimming it to bare poles. Then either one or both of two types of grafting may be practised.

The peg or chisel graft is inserted by driving a chisel cut an inch into the wood, and again driving into this cut a short strong

A Strap Graft, tied and ready for waxing.

graft. This graft is usually set at right angles to the growth.

The bark graft is worked by inserting a one-sided cut graft into the bark, cutting the bark in the way it would be cut for a bud. These grafts may be made very secure with a small brass or iron tack.

The third method is to cut back all of the laterals, leaving an inch of the length. Into this short piece is inserted either a wedge or strap graft of the new variety.

After the grafts have been inserted, in every case they should be coated with an air-tight mixture, using either pitch, grafting wax, or the colas-starch preparation. In late spring all strong growing grafts should be topped to prevent breakages.

In many parts of the State, trees that were grafted last winter carried fruit in the past season. Growers thus do not have to stand the heavy loss of waiting for two or three years, as under the old method.

A Strap Graft—the scion is two years old.

The Vegetable Garden.

Broad beans and green peas should be sown during the month; while in the warmer districts french bean seeds may be sown. All of these give the best crops when sown in a good soil, and each is fond of lime. In order to assist in checking anthracnose, or brown spot of broad beans, the seed should be soaked in a solution of bluestone for half an hour before planting, using 1 ounce of bluestone (copper sulphate) to a pint of water.

Before covering, the seeds of these three vegetables should be well dusted with lime. Daisy and William Hurst are two good early green peas, and Greenfeast or Yorkshire Hero will suit for the main crop.

Land for tomato growing should be well manured with animal manure if available. This should be dug well into the soil. Young tomato plants may be set out, giving them a sunny aspect, and protecting them from any possible frost by a screen of tin or wood. If there are not too many plants, it will be helpful to cover them at night with shields of hessian, paper, &c. Tomatoes are semi-tender plants, and the more protection they receive the earlier they will fruit.

Seeds of radish, mustard and cress, and parsley should be sown in beds, and seeds of lettuce in rows 9 inches apart. Lettuce seed should be sown in a well-drained bed which has been liberally treated with old stable manure.

Professional Papers

[This section is devoted to professional papers and articles of a scientific character.]

Blue Mould of Tobacco

On the Morphology of the Fungus and its Nomenclature

By D. B, Adam, B.Agr.Sc., Plant Pathologist

RECENT references to the outbreak of blue mould in tobacco in various countries lend an added interest to a disease which for a long time has been established in Australia. Apart from its economic importance as the cause of a destructive disease of tobacco plants, especially when they are in seed beds, the fungus is interesting in that it apparently provides a case where an indigenous fungus, by extending its host range to include a closely related introduced plant, viz., *N. Tabacum,* has created a serious problem for the tobacco grower.

Historical.

From records, chiefly contemporary press articles and the accounts of growers, it appears that the earliest attempts at growing tobacco in Australia were made about 75 years ago, and that at a very early date the crops were ravaged by mildew. However, scientific attention to the mildew does not seem to have been given till the year 1890. In 1883 Cooke (2) published a list of the then known Australian fungi, but neither in this list nor in Bailey's synopsis (3) (1886-90) were any species of *Peronospora* included. About this time Farlow (1885), on an expedition to California discovered a fungus occurring on the leaves of *Nicotiana glauca* Graham. "Microscopic examinations," he wrote, "showed that the fungus in question is *Peronospora hyoscyami* De Bary," but he gave no detailed description of the fungus.

In February, 1891, M. C. C. (Cooke) (4) described a fungus responsible for a tobacco disease as *Peronospora hyoscyami* De Bary. He stated that it was not a new species since it was known to attack *Hyoscyamus* in Europe. The spore dimensions given were exactly the same as *P. hyoscyami* De Bary (5). No habitat was mentioned.

W. G. S. (Smith) (6), commenting on this article, pointed out that in considering the question of host Cooke had overlooked Farlow's record in 1885 of *P. hyoscyami* occurring on *N. glauca* in California.

Cooke, in his handbook of Australian fungi, published in 1892, gives a diagnosis of *P. hyoscyami,* which is obviously copied from De Bary's; tobacco is described as the host, and Queensland as the habitat.

In July, 1890 (7), there was published a copy of a report by Tryon on tobacco diseases at Texas, Q. Tryon is reported to have stated, "The disease . . . is immediately due to a fungus, a species of Peronospora, a germ . . ." Although he stated his intention to deal with this matter in his next report on insect and fungus pests, no further reference to this subject can be found in subsequent Government reports.

This article marks, apparently, the first occasion upon which *Peronospora sp.* was associated with a disease of cultivated tobacco.

In October, 1891, Cobb (8) described a mildew on the underside of tobacco leaves as caused "by what appears to be the fungus known as *Peronospora hyoscyami* De Bary . . ." The description given is evidently original, for, unlike Cooke's description, it differs in detail from De Bary's description of *P. hyoscyami.*

In Cobb's article the information supplied by Mr. Turner, botanist, "that this weed," referring to *Hyoscyamus niger,* "is abundant in some parts of this country," is difficult to understand in the light of present knowledge. Maiden (9) certainly lists *Hyoscyamus niger* as a foreign solanaceous plant naturalized in New South Wales, but the record apparently is based on a single specimen from Glenbrook, collected in December, 1906, and said to have escaped from cultivation; actually since then no specimens of this plant have been received at the Sydney Herbarium.*

In 1891 Spegazzini (10) described a *Peronospora* as occurring on *Nicotiana longiflora* from Buenos Aires. To this fungus, both the conidia and oospores of which he described, he gave the name *Peronospora nicotianae n. sp.*

In 1899, McAlpine (11) found on *Nicotiana suaveolens* "the selfsame fungus, which attacks the cultivated plant, viz., *Peronospora hyoscyami* De Bary." This case he considered an illustration of the transference of a fungus from its native host to an introduced plant cultivated for its economic worth, although he does not mention any experiments verifying this hypothesis.

In 1908 Wilson (12) transferred the fungus determined by Farlow as *P. hyoscyami* to *P. nicotianae* Speg. for two reasons, viz.—(1) That the species of *Peronospora* on *H. niger* belonged to the section *Intermediae* (A. Fischer) while the Nicotiana inhabiting *Peronospora* belonged to the section *Divaricatae.* (2) That a comparison of the American material with the description of Spegazzini's species showed a close conformity thereto.

Neither of these grounds seems a sufficient warrant for the change, especially the second, where, in the comparison, oospore characters were necessarily ignored, for the reason that oospores were unknown in the Californian material, although quite well known in the Argentinian material.

In 1914 Wilson (13) referred again to *P. nicotianae* Speg. Discussing the distribution of the fungus, he stated that "Harkness and Moore have recorded *Peronospora sordida* on *Nicotiana Bigelovii,* from Nevada." The ground for this statement is obscure, for, according to Lindau and Sydow (14), Harkness and Moore were responsible for only one joint work. In this they cite *P. sordida* on *Scrophularia,* but no *Peronospora* on any species of *Nicotiana.*

Later in the same article Wilson says, "A seed bed disease of tobacco plants in Australia caused much loss to the tobacco of the colony of Victoria. Material submitted to Professor Massee for identification was pronounced *P. sordida* Berk." The grounds for this last statement are equally difficult to understand.

In the Kew Herbarium there are three good collections of *Peronospora* on tobacco from Australia all referred to *P. hyoscyami.* In the *P. sordida* folder all the collections are on species of *Scrophularia* and *Verbascum,* and on hosts of no other families.

In 1913 Massee (16) described *P. sordida* as "parasitic on the under surface of leaves of plants belonging to the order Scrophulariaceae as . . . ." It would appear from this that Massee himself did not think *P. sordida* occurred on species of *Nicotiana.*

Peters and Schwartz (17) mention the occurrence of *P. nicotianae* in Sicily, although, so far as can be ascertained, no reference to this occurrence is made in the literature of Italian mycology. The error may have arisen through a name association suggested by the habitat of *P. nicotianae,* which is given by Saccardo on "In nemerosis Palermo vocatis, prope Buenos Aires, Argentine, Amer. merid." Palermo being better known as the name of an important town in Sicily, than as a wood in the suburbs of Buenos Aires.

Gaumann (18) in 1923, apparently without having had access to all the material, considered that the species of *Peronospora* recorded on *Nicotiana spp.,* including *N. Tabacum,* should be referred to *P. nicotianae* Speg.

Description of the Fungus.

The mycelium is internal and intercellular, with branched haustoria which penetrate individual host cells. The hyphae, especially in the mesophyll region of the leaf, are irregular shaped, non-septate, and have granular protoplasmic contents.

One, two, three, or more conidiophores may emerge from stoma on either leaf surface, though more commonly from those on the under surface.

The conidiophores are up to 820μ long, five to 8 times dichotomously branched, the curvature of the branches increasing to the ultimate branchlets which diverge obtusely, and are slightly curved or recurved, from 8μ or less to 14μ long, and end bluntly.

* I am indebted to Dr. Darnell Smith, Director of the Sydney Botanic Gardens, for the information concerning the distribution of *Hyoscyamus niger* in New South Wales.

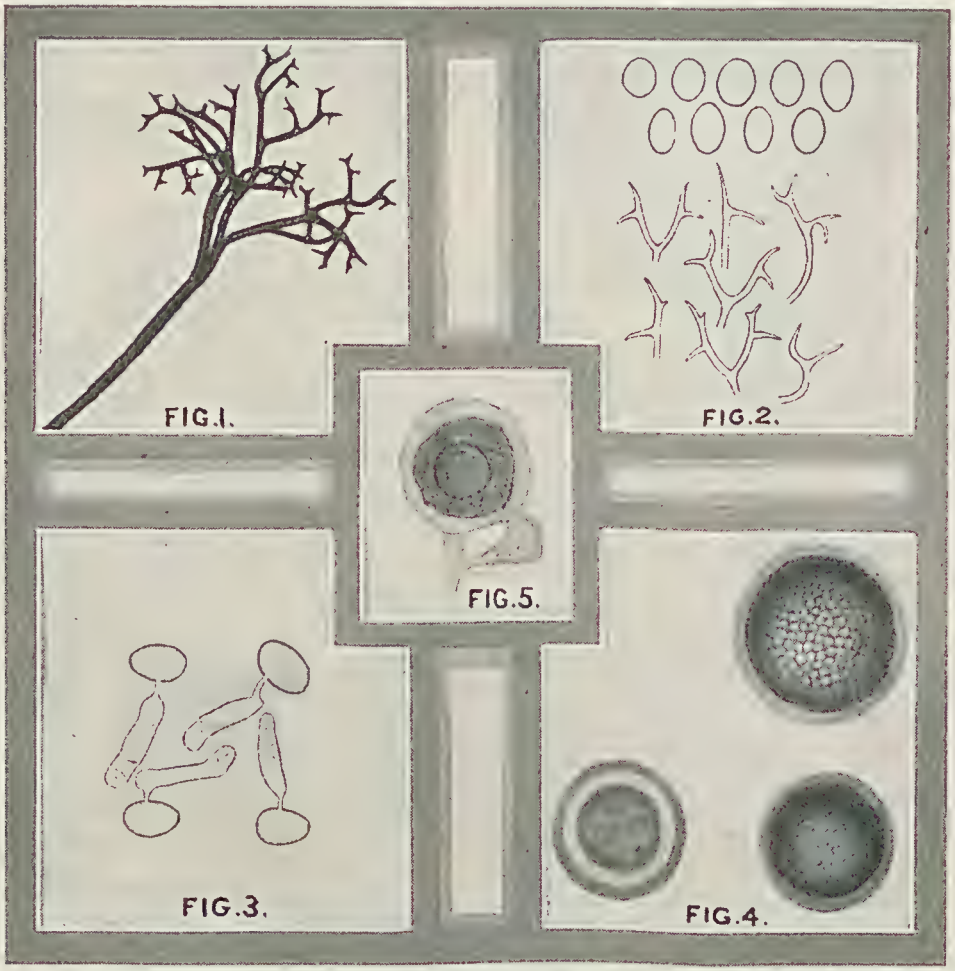


Fig 1.—A conidiophore of Peronospora tabacina, showing profuse branching, × 100. Fig. 2.—Conidia and ultimate branchlets of conidiophores, × 250. Fig. 3—Showing germinating conidia, × 400. Fig. 4.—Illustrates the relative size and epispore characters of P. nicotianae (upper) and P. tabacina, × 400. Fig. 5.—Drawing of Oospore of P. tabacina showing antheridium, × 400.

In our material produced under a variety of environmental conditions we have never seen three to four times branched conidiophores such as were typically present in the material of *P. hyoscyami* examined. Conidia are produced on the tips of the conidiophores; they are ovoid to ellipsoid, thin walled, hyaline to dilute violet colour. They vary from 29 to 16μ long by 19 to 13μ wide, their average dimensions being 22μ x 17μ. These conidia, when germinated in water, produce germ tubes directly. The germ tube arises from the side of the conidium. No other form of germination has been observed.

The only spores observed on tobacco leaves freshly taken from the field have been conidia. Badly mildewed leaves showing free conidial production were taken and wrapped up tightly in paper, and kept in a drawer. When these were examined a fortnight later it was observed that in the leaf tissue below the old conidiophores and conidia there were now small dark globose bodies. These bodies had a clear central region averaging 30μ in diameter, and an outer denser ring-like region 8 to 10μ thick, external to this lay another thin wall. The bodies described clearly were oospores, of diameters ranging from 35 to

60μ, with an average of 46μ. The epispore was smooth or slightly but irregularly roughened.

More recently the production of oogonia and oospores has been effected repeatedly by keeping mildew-affected leaves under very humid conditions in petrie dishes. Under these conditions oospores similar to those already described were obtained. In addition to these, oogonia with paragynous antheridia were readily observable in the macerated tissue. Numerous attempts have been made to germinate the above described oospores, but they have been unsuccessful.

The fungus described above clearly is a Phycomycete belonging to the genus *Peronospora* Corda. For the reasons discussed below, it is considered a new species, for which the name *Peronospora tabacina* is proposed.

Infection Experiments

Experiments have been conducted on the infection of various species of *Nicotiana* and *Hyoscyamus niger* L. by *P. tabacina* sp. nov. The general method adopted was to prepare a suspension of spores by shaking over rain water in a watch glass a piece of clean tobacco leaf which had produced conidia overnight. This spore suspension was then applied by means of an atomiser to the leaves of a number of healthy seedlings growing in a seed pan. At the same time *N. Tabacum* seedlings were inoculated in the same way to serve as a control on the viability of the inoculum used. In addition, in most cases the spore suspensions were kept and examined to determine if the spores had germinated. After inoculation the plants were kept under greenhouse conditions and in a moisture-saturated atmosphere for 24 hours or longer.

Under these conditions conidia from *N. Tabacum* L. were found to infect and produce typical conidia and conidiophores on the following hosts:—*Nicotiana glauca* Graham, *N. suaveolens* Lehm., *N. rustica* Linn., *N. longiflora* Cav. That is, upon all species of *Nicotiana* that were tried. When the conidia produced under these circumstances on *N. suaveolens* and *N. longiflora* were transferred back to *N. Tabacum*, they reproduced the typical lesions of blue mould on this host.

However repeated attempts have failed to produce an infection on *Hyoscyamus niger* Linn., although steps were taken to inoculate plants at all stages of development.

Discussion.

Peronospora tabacina sp. nov., by reason of its morphology and host range, appears to be most closely related to *P. nicotianae* Speg. on the one hand and *P. hyoscyami* De Bary on the other. For this reason authoritatively named material of both these species has been examined.

With regard to *P. nicotianae* and *P. tabacina*, a critical comparison reveals the following differences:—

(1) The ultimate branchlets of *P. nicotianae* are uniformly longer and more acutely pointed than are those of *P. tabacina*.

(2) The conidia of *P. nicotianae* (19μ by 10μ) are smaller than those of *P. tabacina* (22μ x 17μ).

(3) The diameter of the oospores of *P. nicotianae*, 50μ-80μ, is much greater than that of *P. tabacina* (35-60μ, av. 46μ).

(4) The colour of the oospores of *P. nicotianae* is golden brown, that of *P. tabacina* dark brown.

(5) The epispore of *P. nicotianae* is close and regularly warted or areolate; in *P. tabacina* it is smooth or slightly roughened.

Under artificial conditions *P. tabacina*, however, is able to infect *N. longiflora*, the natural host of *P. nicotianae*.

The differences in the epispore distinguish sharply these species. Significance is also attached to the marked differences in size of the oospores.

In comparing our fungus with *P. hyoscyami* De Bary difficulty is met with in delimiting some of the features of *P. hyoscyami*.

Berlese (19), in examining some of von Thuemen's material of *P. hyoscyami*, created a new species, *P. dubia*, mainly on the grounds that in his material the conidiophores were smaller and much less branched than those described for *P. hyoscyami*. Gaumann and others question the validity of this particular species. In material determined by Gaumann as *P. hyoscyami* which we examined, the conidiophores were short, three to four times branched, and much more closely in accord with the description of *P. dubia* Berlese than with that of *P. hyoscyami* De Bary.

Bakhtin (20) has recently dealt with the fungus *P. hyoscyami*. His description of the conidiophore and conidium of *P. hyoscyami*,

a species which he distinguishes from *P. dubia* Berlese, accords with Gaumann's account of *P. hyoscyami,* and also with that of our own tobacco *Peronospora,* though the average length and breadth of the conidia as given by Gaumann are 2μ greater than those for the conidia of our own fungus.

Bakhtin, in addition, described and figured the oospores of *P. hyoscyami.* They are 30 to 40μ in diameter, with a thick perinium on their surface, bearing irregular folds which give them a rounded angular shape.

The oospores of *P. tabacina* are a good deal larger in diameter (35μ to 60μ) and the epispore is smooth and round, and is free of the marked folds characteristic of the oospores of *P. hyoscyami* De Bary, as described by Bakhtin. Furthermore, the attempts to artificially infect *Hyoscyamus niger* with *P. tabacina* have not been successful.

The character of the oospores serve to distinguish *P. tabacina* from *P. hyoscyami,* while the host relations of the two organisms are also apparently quite distinct.

Diagnosis.

Peronospora tabacina—Species Novum. Caespitulis densis, griseo-violaceis, conidiophoris singulis vel plurimis e stomatibus exeuntibus, 500–850μ altis 5–12μ crasso, ramis 5–8–ies dichotome ramosis, Furcis terminalibus 5–14μ longis, rectangulo divaricatis rectis vel curvatis. Conidiis leviter violaceis vel hyaline, ellipsoideis 16–29μ longis—13–19μ latis. Oosporis globosis, 35–60μ diam., episporo brunneis, laevi vel leviter rugoso irregulariter. Habitat in foliis vivis, *Nicotiana suaveolens* Lehm., *Nicotiana Tabacum* L., Victoria, Australia.

Summary.

(1) An account is given of the history and relationships of the different Nicotiana-inhabiting species of *Peronospora.*

(2) A description is given of a species of *Peronospora* attacking the cultivated tobacco—*Nicotiana Tabacum* L., in Australia.

(3) Reasons are given for the belief that the fungus described is distinct from any previously described, for which the name *Peronospora tabacina* is proposed.

The writer desires to acknowledge his indebtedness to fellow officers for help that they have given him. In this connexion I wish to mention specially Mr. C. C. Brittlebank, formerly Biologist in the Department, whose keen enthusiasm for things mycological was a great source of help. I am also indebted to Dr. Butler and the staff of the Imperial Mycological Institute, England, for extensive assistance with the literature of the subject dealt with above.

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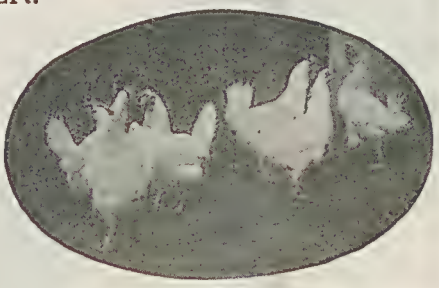

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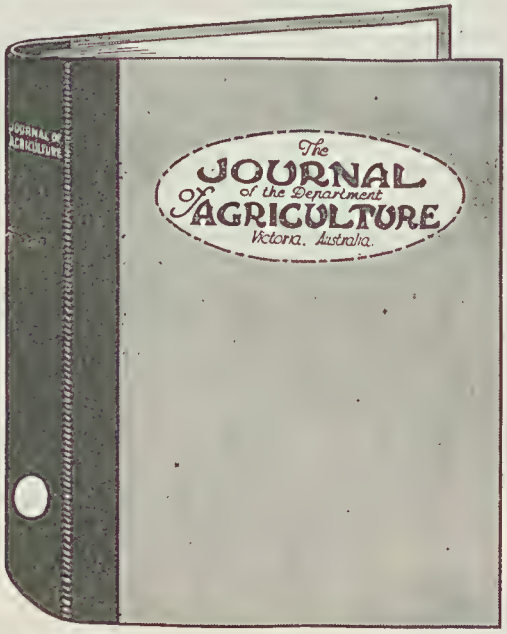

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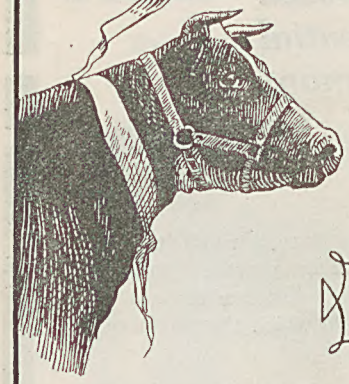

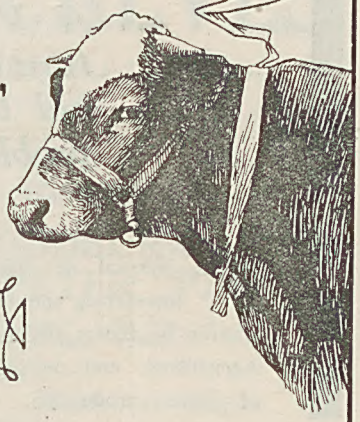

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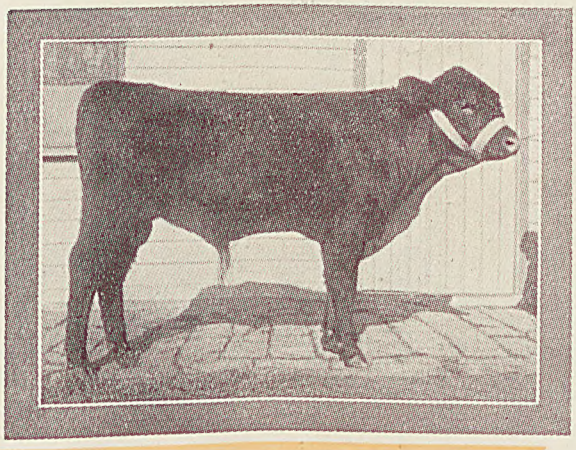

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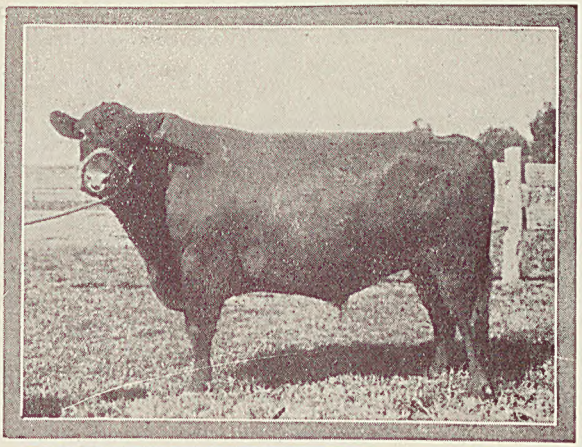

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